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MAY 7, 1932
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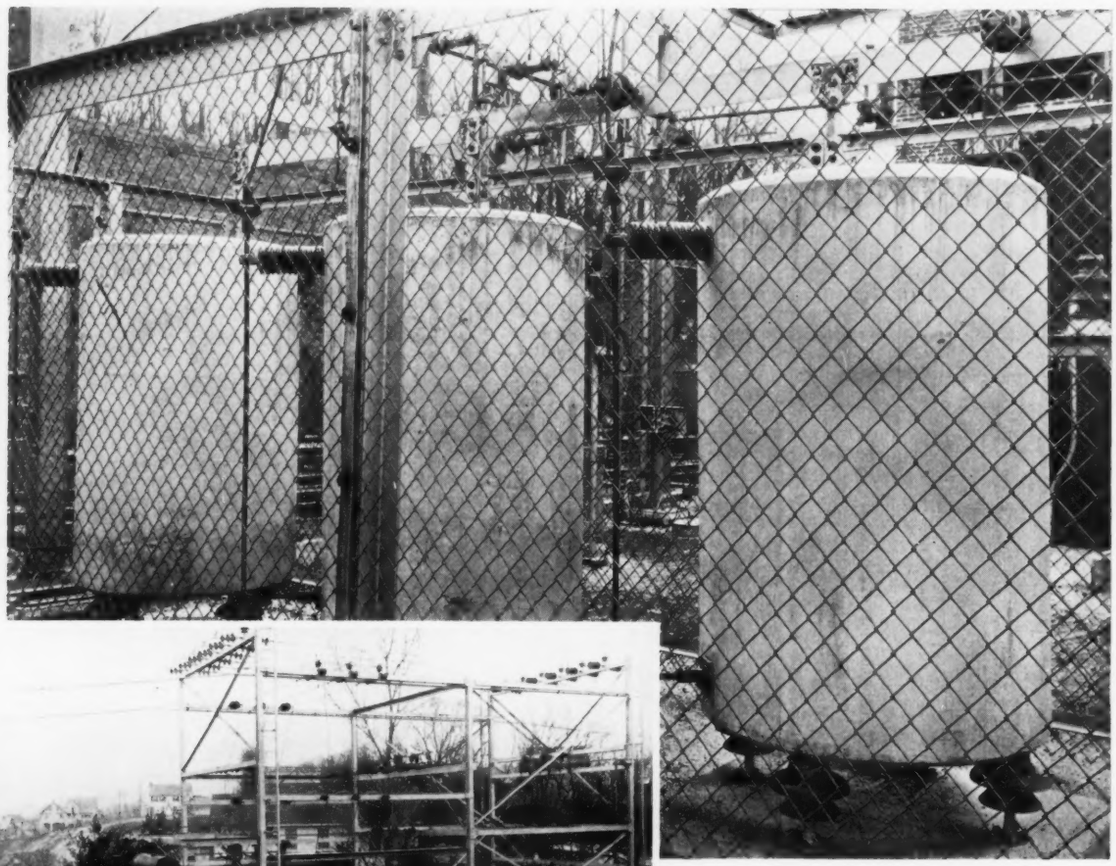

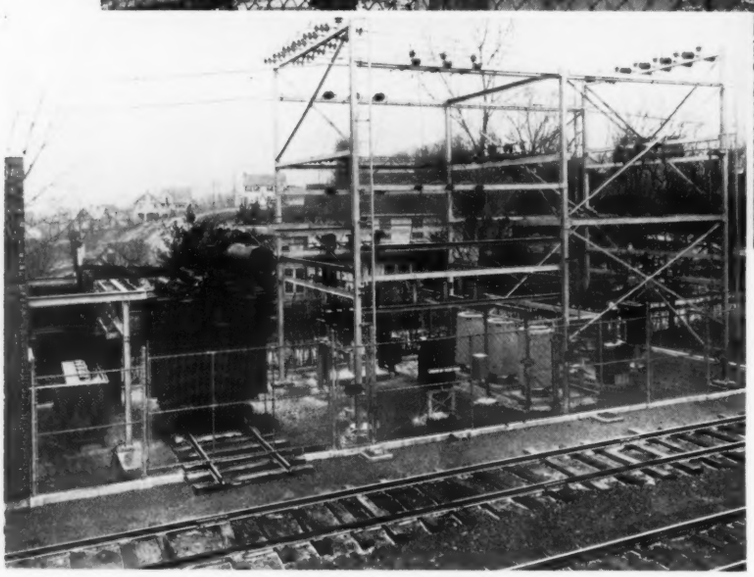

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ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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MAY 7, 1932

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VOLUME 99 . . . NUMBER 19

Overhead Secondary Network Offers Real Economy.....808
By JOHN S. PARSONS AND LEONARD M. OLMSTED, *Westinghouse Electric & Manufacturing Company*

Electrical Therapeutics in Industry.....816
By SANFORD DEHART, *R. K. LeBlond Machine Tool Company*

Energy Data Given by 172 Large Systems.....818

Providence Plant Transfer Inaugurates Striking Economies.....822

How Toledo Edison Cut Accidents 90 per Cent.....826
By A. HOEFLE, *Toledo Edison Company*

News of the Industry.....793
Editorials.....804
What Modernized Lighting Did for One Church.....813
Tuning Fork and Stylus Show Circuit Breaker Speed.....814
Providing Automatic Operation of Embossing Press.....815
Radio Complaint Exposed Hazard.....817
79 Per Cent Load Factor in Tasmania.....821
Wattmeters Give Power Factor on Unbalanced Load.....823
New 220-Kv. System for France.....824
Electric Service to Oil Refineries.....824
Closed Delta May Be More Economical Than Open.....827
Readers' Forum.....828
Men of the Industry.....829
Trade Notes.....831
New Equipment Available.....832

Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

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ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

May 7, 1932

Auction of Insull holdings halted; Martin J. Insull resigns

—**Bank sales of pledged stocks** of Insull investment companies to clear payments in default enjoined. "Big three" blocks totaling $10,325,000 involved. Martin J. Insull quits presidency of Middle West Utilities Company—*p. 795.*

—**Gadsden urges co-operation** to assist in the solution of some of the electrical industry's much-debated problems. Fuller information for commissions and code of ethics among specific suggestions—*p. 794.*

10-cent "Mazdas" to be marketed

—**New line of lower-cost lamps** to be offered by licensees. With a life of 500 hours and a rigid maintenance of "Mazda" quality, the competition of cheap, inferior imports should be killed—*p. 803.*

—**Overhead secondary networks** analyzed and comparative costs for various distribution plans developed. Results indicate a definite economy when applied with known variables in mind—*p. 808.*

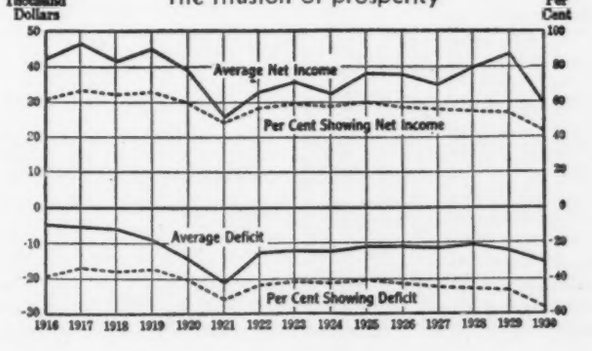
—**Energy statistics for 1931** show that 142 light and power systems in the United States generated 92 per cent of the nation's total; New York Edison leads in output; industrial use falls as domestic rises—*p. 818.*

—**Accidents reduced 90 per cent** by Toledo Edison Company. Support of management and policy of requiring oral report by responsible supervisor to central committee, as well as education of employees, aided—*p. 826.*

—**Welding problems discussed** at the annual meeting of the American Welding Society. Symposium on ductility a feature as the importance and some fallacies in its emphasis were developed. McKibben becomes president—*p. 795.*

—**A merchandising committee** acting for N.E.L.A. and retailers' associations reports utilities as selling 32 per cent of all appliances while department store sales account for 30 per cent of table appliances—*p. 794.*

The illusion of prosperity


Thousand Dollars
Per Cent
Average Net Income
Per Cent Showing Net Income
Average Deficit
Per Cent Showing Deficit
1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930

In the annual report of the Commissioner of Internal Revenue figures covering fifteen years are presented which show that the proportion of American corporations which earn a net income in any given year never exceeds two-thirds of those reporting. The chart shows percentages reporting net incomes and the average net income and deficit for each corporation. In 1929 those showing a net income constituted 53 per cent of the total.

P. H. Gadsden Takes Advanced Stand on Public Utility Regulation

Wants powers of state commissions strengthened, charges of holding companies reviewed and regulatory bodies set up where none exist.

A NOTEWORTHY event at the convention of the Missouri Association of Public Utilities, held April 28-30 at Excelsior Springs, was the paper by Philip H. Gadsden, vice-president United Gas Improvement Company, Philadelphia, on "Public Relations in the Utility Field." Asserting that "the guiding principle in rate making should be, not 'all the traffic will bear,' but how low can the rates be reduced to meet competition and to induce the largest possible use of our services," Mr. Gadsden called attention to "the increasing volume of criticism of public utility holding companies," deprecated utility opposition "to any and all amendments to public service commission laws," and advocated "effective, courageous, comprehensive regulation." To this end he recommended the following policy:

1. To strengthen the regulatory powers of all public service commissions to the end that they should have full information concerning all factors which enter into the quality and cost of service to our customers, and to establish commissions in states where such bodies do not now exist.

2. To give public service commissions full information regarding the contractual relations between holding companies and their subsidiaries.

3. To determine a principle for the valuation of public utility properties upon a basis which would command the support of both the public and the owners of the properties.

4. To continue our efforts to develop the code of ethics of public utility management to a point where the industry will cease to become a trade and will be classed as a profession.

On the holding-company situation Mr. Gadsden said:

The rate payer must be convinced that the fees charged by the holding company for services are just and reasonable, and, in my opinion, the best way to achieve that confidence is to have the compensation of the holding company approved by a public service commission. If the commission had authority to pass upon the contractual relations between holding companies and their subsidiaries, there would be no more reason for the regulation of the holding company in the public utility field than in any other field of American business. I realize that the proposal that management fees of holding companies should be approved by public service commissions will not meet with the general approval of public utility executives, but I am convinced that it is necessary, in order to strengthen the principle of state commission regulation, that such agencies be fully informed of all factors which enter into the consideration of rates and service.

Instead of insisting upon the strict application of the valuation principles announced by the United States Supreme Court, it would seem to be the part of wisdom to co-operate with all those seeking to find a permanent and satisfactory solution of this question and to give serious and sympathetic consideration to the various suggestions which are now being made by earnest students of this problem. If a principle for the valuation of public utility properties could be determined at this time on some basis which would command the support of the public and the owners of the properties this vexatious question would disappear from the field of public discussion.

▼

Dnieper Hydro Plant Test — Transmission at 400 Kv.?

Associated Press dispatches from Russia dated May 1 say that on that day the great hydro plant on the Dnieper River received its first test, three 84,000-hp. units being set in motion. This plant, designed and built by Hugh L. Cooper of New York, was described briefly in the ELECTRICAL WORLD for April 2 (page 595), and several views of it have been printed at various times. It is now said that energy for actual use will be transmitted in August and that all the nine units will be finished in another year.

Hugh L. Cooper

The Russian electrical journal *Electritchestvo* says that the Soviet government plans to erect a transmission line between Svire, Leningrad and Dnieprostoi to transmit power at a potenial of 400 kv. Leningrad is about 800 miles from the site of the plant.

▼

Merchandise Distribution Analyzed by Dameron

Utilities sell 32 per cent of appliances, department stores 24, electrical specialty shops 10, hardware only 0. 9.

Data on the outlets for the distribution of electrical merchandise are included in a survey made by Kenneth Dameron, appointed director of the joint committee on electrical merchandising set up last year by the dry goods and hardware dealers' national organizations and the N.E.L.A. A preliminary report was noted in the ELECTRICAL WORLD for March 12 (page 473). In the survey just completed manufacturers reported their sales to retailers by type of outlet, indicating the percentage of total sales to each. Slightly more than 60 per cent of the manufacturers reported for 1931.

The data on distribution outlets were broken down into two classifications. One shows that in the distribution of all types of electrical appliance the utilities led with 32 per cent of the total. The department stores followed with 24 per cent, and electrical specialty shops with 10.2 per cent. The remaining outlets ranked by percentages as follows: Furniture, 9.9; electrical contractors, 8.6; manufacturers' branches, 6; radio, 2.5; mail order, 1.9; plumbers, 1.6; music, 1.5; hardware, 0.9; jewelers, 0.6, and drugs, 0.3.

A somewhat different line-up is evident in the second breakdown dealing with table appliances, in which department stores were the leading retail factor. The distribution of this merchandise by kind of outlet was: Department stores, 30 per cent; utilities, 18; electrical specialty, 18; electrical contractors, 16; furniture, 5; mail order, 4.4; jewelers, 4; manufacturers' branches, 3; radio, 1.1, and music, 0.5.

Mr. Dameron's deductions follow in part:

As retail outlets, utilities and manufacturers' branches were important in products requiring pioneering and involving high promotional costs. These are invariably the heavy load-building appliances. Apparently typical retail institutions, such as department stores, furniture and hardware stores, are reluctant to engage in pioneer merchandising.

Electrical dealers, in contrast to non-electrical dealers, are dominant in the retail distribution of products where technical skill is important. This is especially true in smaller cities where the non-electrical dealers are unable to handle adequately installation, service and repair.

Hardware stores are apparently not taking advantage of marketing opportunities,

even in states and cities where utilities have ceased to merchandise. This may be due to lack of capital and inability to finance the consumer. In certain areas wholesale distributors have a plan to finance retail customers of hardware stores.

Drug stores, while doing a creditable business in table appliances, fans, small heaters and electrical supplies, are apparently overlooking the market opportunity resulting from the demand for heating pads, health lamps and related lines. This business seems to be going to the utilities.

Mail-order-house retail branches are engaged in the active promotion of most appliances. They are especially significant factors in the lower-price grouping.

Leased sections superimposed upon retail outlets are apparently on the increase. This may result from the caution and the experimental attitude of many dealers. . .

The independent specialty type of distribution is apparently coming to a standstill.

▼

Southern Hardware Dealers and Utilities to Arbitrate

Merchandising of electrical and gas appliances was a leading topic at Memphis, last week, when Charles A. Collier, vice-president Georgia Power Company; W. H. Hanna of El Dorado, Ark., and other utility company men participated in a discussion with representatives of the Dixie Hardware and Implement Association meeting in convention, with delegates present from Florida, Georgia, Alabama, Mississippi, Arkansas and Tennessee. Resolutions were passed recommending that a utility and hardware dealers' board of arbitration be set up to handle merchandising problems arising in this territory.

▼

Phoenix Company Will Aid Retailers Actively

A co-operative load-building plan has been proposed by the Central Arizona Light & Power Company, Phoenix, and has been approved by all dealers in electrical and gas appliances in that city. The company plans to use its sales promotion department to promote sales by the dealer as well as the company. Among the methods favored are cooking schools in the power company auditorium, joint displays of appliances, shows, newspaper cooking schools and co-operative advertising campaigns.

Business Activities Slump Again

FURTHER recessions in energy production figures, in car loadings, in volume of retail sales and in security markets developed this week. Copper touched 5⅛ cents, an all-time low. Railroad earnings down.

In response to continued inflation propaganda the House of Representatives passed the Goldsborough bill directing the Federal Reserve System to employ its control over credit and currency in an effort to restore commodity prices to approximately 1926 levels. House also approved the $100,000,000 World War widows and orphan's bill after 40 minutes' debate, and when the much-heralded omnibus economy bill goes through there is but $30,000,000 saving left of the once-foreseen $206,000,000.

Gold flows overseas and the dollar drops on foreign exchanges as other nations foresee the ultimate result of inflationary policies and hasten to make their investments secure while there is yet time.

▼

Auction of Pledged Insull Securities by New York Banks Enjoined

FOR a minimum sum of $10,325,000 four New York banks were to have auctioned on Thursday of this week blocks of the common stocks of the Insull "big three" companies which were pledged by Insull Utility Investments, Inc., and the Corporation Securities Company against bank loans.

The Commercial National Bank & Trust Company, Chase National Bank, Guaranty Trust Company and Central Hanover Bank & Trust Company offered in the aggregate 77,516 common shares of People's Gas Light & Coke Company, or 11.23 per cent of the total amount outstanding; 50,981 common shares of Commonwealth Edison Company, or 3.25 per cent of the total issue, and 2,987 common shares of $100 par value and 21,567 common shares of no par value of the Public Service Company of Northern Illinois, representing 2.27 and 4.43 per cent of the respective outstanding issues of these shares.

Minimum asking prices were based upon either average closing prices of the securities for certain preceding dates or the closing prices on specific dates.

An injunction in the United States District Court put a stop to these plans. Judge Lindley of Chicago entered the restraining order on the grounds that the intrinsic value of the stocks to be auctioned exceeded present market prices and that such disposal would be detrimental to the creditors and stockholders of the Insull investment trusts.

Insull Utility Investments and the Corporation Securities Company together had pledged with New York and Chicago banks 155,755 People's Gas Light & Coke, 242,449 Commonwealth Edison and 57,987 Public Service of Northern Illinois common shares against loans that have been defaulted as a result of the receivership of the two companies.

Martin J. Insull resigns

An announcement was made on May 3 by Martin J. Insull, president of the Middle West Utilities Company, that he had retired from that organization and its subsidiaries. Mr. Insull had been president of Middle West since 1924. The operation of the properties is now directed by the receivers, Edward N. Hurley, Samuel Insull and Charles A. McCullough.

▼

Muscle Shoals Debate in House of Representatives

Brought up in the House under special ruling on Wednesday of this week, debate on the new bill providing for operation of the government plants at Muscle Shoals was waged for five hours, many opponents and advocates of government ownership taking the opportunity to expound their respective points of view. It was hoped to reach a vote on Thursday.

The main provisions of this bill were printed in the ELECTRICAL WORLD for March 19 (page 516).

▼

Chicago Council Starts Own Utility Investigation

Alderman Barnet Hodes has been made chairman of a subcommittee which is to conduct an inquiry into the regulation of public utility companies in Chicago and Illinois. Public hearings will be held with the object of drafting state legislation. In a statement issued by Alderman Hodes he says:

Since neither the State Legislature nor the Commerce Commission has taken steps to improve the character of the existing machinery of regulation, the city of Chicago, in the performance of its obligations to its citizens, must undertake to determine what steps are necessary in order to remedy this intolerable situation.

It is for that reason that I proposed this study and investigation of measures necessary to provide the people of the city and state with effective and competent regulation of public utilities. In so doing we propose to study the record of the Commerce Commission as well as the work and accomplishments of other state commissions which, from the public's point of view, have been more successful in their operation. It is also essential that we determine the relative feasibility of home rule and of state control of these companies.

Supreme Court Confirms George O. Smith

UNANIMITY marked the decision of the United States Supreme Court handed down by Justice Brandeis on Monday of this week which confirmed George Otis Smith in his position as chairman of the Federal Power Commission. The constitutional question at issue, as explained in previous numbers of the ELECTRICAL WORLD, was whether the Senate after indorsing a presidential nominee can recall its notification to the President of such approval provided that two days of executive session shall not have passed without the entry of a motion to reconsider. President Hoover, it will be remembered, refused to send back the names of Dr. Smith and two other appointees to the commission when Senators took umbrage at the new commissioners' action in dismissing employees around whom a controversy involving jurisdiction and accountancy as affecting applicants for hydro-electric licenses had been waged. The Senate then proceeded to make a test case as regarded Dr. Smith.

▼

Westchester (N. Y.) Rates Cut $700,000 a Year

Rates of the Westchester Lighting Company, an affiliate of the New York Edison group serving Mount Vernon, New Rochelle, White Plains and many other sizable places in Westchester County, north of New York, will be reduced by a sum estimated at nearly $700,000 a year by a new schedule of rates just filed with the Public Service Commission after somewhat protracted hearings.

Customers of the Westchester Lighting Company have long protested against what they held to be unduly high rates. The new schedules, which, it is said, reduce the bills of about 85 per cent of the residential users, involve a minimum bill of $1 for 8 kw.-hr. a month. The next 22 kw.-hr. each month will be charged for at 8 cents a kilowatt-hour; the next 170 at 6½ cents, and all above 200 kw.-hr. at 5 cents.

▼

Problems of Ductility Occupy Welding Society

Just what is implied by the term "ductility" as applied to welds and just how important it is that welds should have this quality was a main topic of discussion at the annual meeting of the American Welding Society, held in New York on April 27-29. Prof. H. F. Moore of the University of Illinois said that "ductility" conveyed different ideas to the manufacturer, the structural engineer, the tester in the laboratory and the designer of machinery. Professor Moore's object was not to elucidate every phase of the matter but to stimulate thought upon it.

Prof. C. A. Adams of Harvard, Chief Engineer E. R. Fish of the Hartford Steam Boiler Inspection & Insurance Company, Charles H. Jennings of the Westinghouse laboratories, President C. J. Holslag of the Electric Arc Cutting & Welding Company, C. L. Waddell of the Worthington Pump & Machinery Corporation, Dr. D. Rosenthal of the University of Brussels and others gave papers covering many aspects of ductility, and the varying points of view were summed up diplomatically by F. T. Llewellyn, past-president of the society, who presided.

At other sessions the advantages of welding in shipbuilding were explained by navy officers and ship constructors, and a number of papers dealt with fusion, spot and production welding. In a paper on "Pipe Welding for a High-Pressure Steam-Power Plant" E. B. Severs and W. P. Gavit said that the Public Service Electric & Gas Company used welded construction on 730-lb., 860-deg. F. steam lines to obtain perfectly tight joints and to permit a comparison with flanged joints. This seamless steel tubing was the first high-temperature-pressure pipe to be electrically welded and annealed in the shop and oxyacetylene-welded in the field.

Officers elected were: President, F. P. McKibben, Black Gap, Pa.; senior vice-president, A. E. Gaynor; divisional vice-presidents, H. N. Ewertz for New York and New England, A. F. Davis for the Middle East and H. S. Card for the Middle West.

▼

N.Y. Commission Report Notes Progress and Trends

Success along four lines—in encouraging the negotiation of rates between utilities and their customers in lieu of long-drawn-out evaluations and probable subsequent litigation, in combining intricate and numerous classifications into simplified and unified clauses, in the elimination of optional rates and in the promotion of rural electric service—is claimed in high degree for the New

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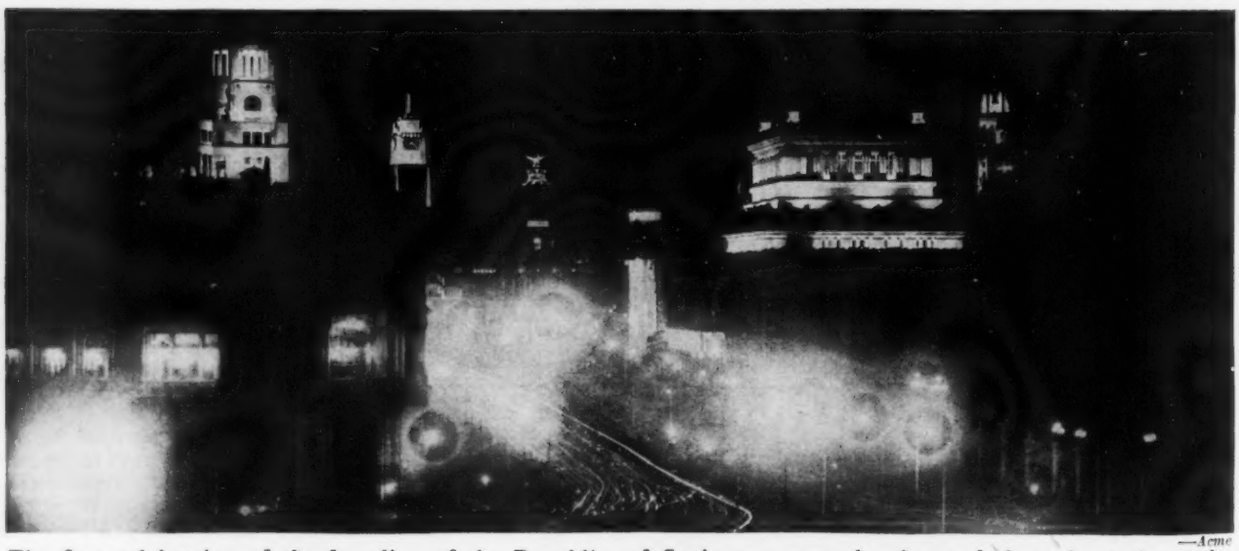
ELECTRICITY HELPS SPAIN CELEBRATE ANNIVERSARY OF REPUBLIC



—*Acme*

The first celebration of the founding of the Republic of Spain was recently observed throughout the entire country. A view of a floodlighted district in Madrid.

York Public Service Commission in its annual report for 1931, now ready in printed form. The commission was instrumental in 1931 in bringing about rate reductions totaling $7,405,000, but the New York Edison figure of $5,500,000 accounts for most of this. The commission notes the growing recognition by light and power companies of the value of domestic service, particularly during business crises. It recognizes also that "the trend is distinctly toward lower residential rates, even under present conditions."

▼

Birmingham Consumers Get Reduction in Rates

Decreased electric rates for certain consumers in Birmingham went into effect May 1 on orders of the Alabama Public Service Commission, about 25 per cent of the domestic consumers and about 33 per cent of the commercial consumers being affected. The saving is estimated at $170,000 annually.

Under the new schedule the rate formerly applying to larger consumers will be allowed for those using less energy. Apartment dwellers whose bill has been running more than $2 will participate in the decrease, as will residence dwellers where bills have been more than $3. A gross rate of $2 a month for the first four rooms or less with connected load of 10 kw. or less entitles the consumer to use 20 kw.-hr. per month, with graduated reductions for additional consumption. The petition of the city of Birmingham for a general reduction to all consumers is still pending.

▼

Missouri Men Hear of Good Merchandising Situation

About 200 men met in Excelsior Springs, Mo., on April 28-30 at the annual gathering of the Missouri Association of Public Utilities. Philip H. Gadsden, vice-president United Gas Improvement Company, who was to speak on public relations, was prevented by illness from being present, and his speech was read by W. H. Henby. It is noted at length on page 794 of this issue.

W. H. Onken, Jr., New York City, vice-president Security Owners' Association, made an address on "The Utilities' Position Relative to the Present Financial Situation." Dr. E. A. White said that 2,000 farms in Missouri had been electrified in the past year, bringing the total number in that state to 16,400. Dr. G. W. Allison, field manager for the National Electric Refrigeration Bureau, urged co-operation, speaking in place of President J. F. Owens of the N.E.L.A., who was prevented at the last minute from attending. H. P. Wright, president Kansas Gas & Electric Company, was another speaker.

The closing session was devoted to merchandising. F. M. Rosenkrans of Kansas City, chairman of the association's merchandising committee, told of widespread co-operation between the utilities and local merchants and dealers throughout the state. John Redmond, editor of the Burlington (Kan.) *Republican*, presented facts and figures showing that the anti-merchandising law is a detriment to the people in Kansas, especially in the smaller towns.

A. E. Bettis, vice-president Kansas City Power & Light Company, was re-elected president of the association, Fred Karr first vice-president and Worth Bates second vice-president. C. E. Michel, St. Louis, was made third vice-president, and N. R. Beagle, Jefferson City, was elected secretary to succeed F. D. Beardslee.

▼

Northern States Power's Rapid Growth Depicted

Opening their testimony, as usual, with an analysis of the set-up and scope of the company under review—in this case the Northern States Power Company—Examiners H. C. Carter and J. C. Dickerman told the Federal Trade Commission on April 26, among many other details, that in 1930 there was on this company's lines a net interstate movement of electrical energy amounting to 293,709,000 kw.-hr. as compared with 349,438,000 kw.-hr. in 1929. The bulk of this movement was from Wisconsin to Minnesota.

On the three following days, and again on Tuesday of this week, Randolph K. Ogle, who examined the Northern States company's accounts in conjunction with Thomas W. Mitchell, went into a detailed and elaborate explanation of the company's financial methods and history. Little of even a mildly sensational type appeared hidden in their intricacies.

Mr. Ogle at one point testified that by certain property acquisitions assets had been appreciated $8,144,975 because the company, except in one instance, "consistently followed the practice of placing acquired properties in its accounts at a gross valuation equal to their appraised cost of reproduction new less depreciation."

At the close of 1929, Mr. Ogle said, there were two corporations named Northern States Power Company, one of which was incorporated in Delaware and the other in Minnesota. The Delaware corporation, he said, functioned purely as a holding company and its only subsidiary was the Minnesota company of the same name, all of whose capital stock of every class was owned by the Delaware corporation. The average rate of return on the total investment in the system for the years 1924 to 1929 inclusive amounted to approximately 7 per cent, including appreciations, and 7.5 per cent, excluding appreciations.

The system grew so fast that the total book value of assets of the Minnesota company increased from $13,268,000 at the close of 1910 to $210,874,000 at the close of 1929, it was set forth. An important component of this consisted of investments in affiliated companies, which increased from $175,000 at the close of 1910 to $45,670,000 at the close of 1929. The Minneapolis General Electric Company was the most important single acquisition, Mr. Ogle said. He told of the purchase for $22,500,000 of St. Paul and St. Croix utilities previously, owned by the American Light & Traction Company. William J. Hagenah, appearing for the Northern States Power, said that the profit of H. M. Byllesby & Company in this transfer was 1.69 per cent of the price.

▼

Senator Would Double Tax on District Utilities

An additional annual tax of approximately $1,449,445 would be levied on District of Columbia utilities under a bill introduced in the Senate by Senator Arthur Capper, Kansas, chairman of the District committee of the Upper House. He estimated the total tax proposed at $2,815,685.

Coming Meetings

National Electrical Manufacturers' Association—Hot Springs, Va., May 15-20. A. W. Berresford, 420 Lexington Ave., New York.

Middle West Division, N.E.L.A. — Muehlebach Hotel, Kansas City, Mo., May 18-20. Thorne Browne, 1527 Sharp Bldg., Lincoln, Neb.

East Central Division, N.E.L.A.—Commodore Perry Hotel, Toledo, Ohio, May 24-27. D. L. Gaskill, 603 Broadway, Greenville, Ohio.

National Electric Light Association — Atlantic City, N. J., June 6-10. A. J. Marshall, 420 Lexington Ave., New York.

Pacific Coast Electrical Association—Hotel Huntington, Pasadena, Calif. June 14-17. K. I. Dazey, 447 Sutter St., San Francisco.

Canadian Electrical Association—Manor Richelieu, Murray Bay, Que., June 15-17. B. C. Fairchild, 409 Power Bldg., Montreal.

Public Utilities Advertising Association—Waldorf Astoria, New York, week June 19. J. R. Pershall, Public Service Co. of Northern Illinois, Chicago.

American Institute of Electrical Engineers—Summer convention, Cleveland, June 20-24. Acting secretary, 33 West 39th St., New York.

American Society for Testing Materials—Chalfonte-Haddon, Atlantic City, June 20-24. C. L. Warwick, 1315 Spruce St., Philadelphia.

American Society of Mechanical Engineers—Bigwin Inn, Lake of Bays, Ontario, June 27-July 1. C. W. Rice, 29 W. 39th St., New York.

New England Division, N.E.L.A.—Mount Washington Hotel, Bretton Woods, N. H., July 11-13. Miss O. A. Bursiel, 20 Providence St., Boston.

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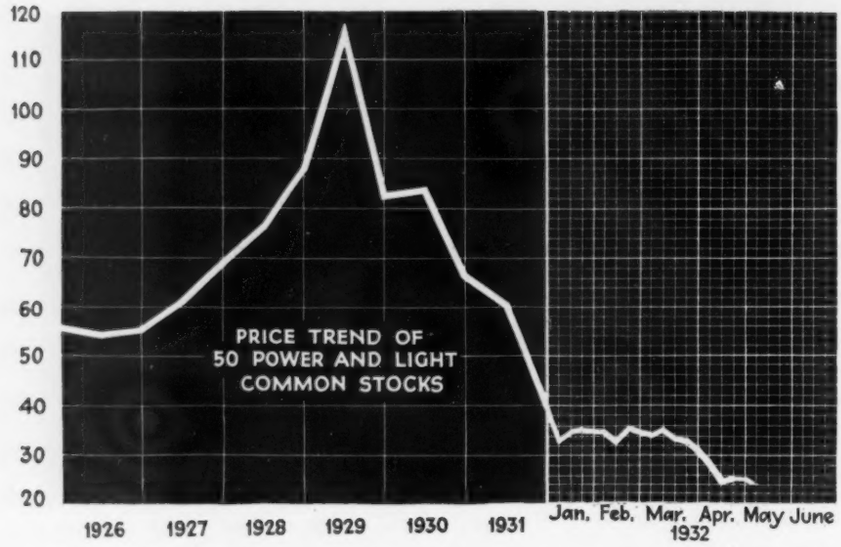
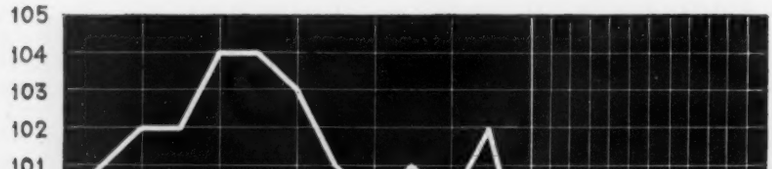
Utility Stocks Down; Bonds Lower



Prices of public utility stocks again drifted to lower levels, some issues reaching new lows. The "Electrical World" index of 50 representative issues was 24.2, as compared with 25.8 for the preceding week, and compares with 24.8, the figure recorded for the second week in April, which up to that time was the low point. Bonds have lost considerable ground in the past month, dropping from 92.3 in March to 88.7 in April.



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Standard Gas & Electric Earns $4.02 in 1931

Standard Gas & Electric Company and subsidiary and affiliated companies had consolidated surplus earnings of $8,706,669 for 1931 after all operating expenses, depreciation in the amount of $14,728,581, interest charges and dividends, or the equivalent of $4.02 a share on the 2,162,607 shares of common stock outstanding December 31, 1931, according to the company's annual report recently issued. This compares with a surplus of $13,082,498 for 1930, or $6.04 a share on the same number of shares of common stock outstanding at the end of that year.

At the close of the year current assets of the Standard Gas & Electric Company system exceeded current liabilities by $12,905,118 and cash resources totaled $17,900,757. Standard Gas & Electric Company has no funded debt maturities until 1935 and maturities of its subsidiary and affiliated companies during 1932 aggregate only $10,693,320, apportioned among four companies in the system.

Gross earnings of Standard Gas & Electric Company's subsidiary and affiliated public utility companies decreased $8,203,677, or 5.33 per cent, and net earnings, before appropriation for retirement of property and for depletion, decreased $1,007,606, or 1.37 per cent, as compared with 1930. A reduction of $7,196,071, or 8.96 per cent, in public utility operating expenses accounted for the relatively small decrease in net earnings.

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Southern California Directors Abolish Office of Chairman

The board of directors of the Southern California Edison Company, Ltd., at its meeting April 29, determined to discontinue the office of chairman of the board, and that the business would go forward under direction of the president, with the advice and counsel of an enlarged executive committee of the board, consisting of George I. Cochran, Henry M. Robinson, Albert W. Harris, Ben R. Meyer, James R. Page, Harry J. Bauer, Russell H. Ballard, president, and George C. Ward, senior vice-president.

▼

National Electric Power Extended Facilities in 1931

In spite of adverse business conditions, the year 1931 was one of continued development, according to a statement made by Harry Reid, president of the National Electric Power Company, in the annual report for 1931 recently issued. Additional properties were acquired by the subsidiary companies, rounding out their holdings along the Atlantic seaboard. The total number of communities served directly increased from 1,904 at the beginning of the year to 2,510 at December 31, with operations extending into 21 states. The number of customers increased from 650,472 to 802,467 and electric output from 1,645,662,501 kw.-hr. in 1930 to 1,884,475,520 in 1931.

Consolidated gross operating revenues totaled $67,512,892, as compared with $62,996,177 for 1930, an increase of 7.2 per cent. Total income, after taxes and depreciation, was $28,604,177, as against $26,311,521, a gain of 8.7 per cent. Net income amounted to $3,308,011 in 1931, as compared with $5,321,299 in the previous year.

After dividends on the preferred stocks of the company, the balance applicable to common stocks was equivalent to $1.86 per share on the 1,176,208 average shares of combined A and

B stocks outstanding during the year 1931. This compares with $3.71 per share for the year 1930 based on the 1,136,085 combined average shares outstanding during the year 1930.

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Dividends Canceled After Declaration

Can a corporation rescind a dividend declaration duly passed on by the board of directors? Central & Southwest Utilities Company has notified the stock exchanges that the quarterly dividends authorized on the prior lien preferred stocks of this Insull Middle West holding company have been canceled.

The securities committee of the Chicago exchange ruled the order rescinding the dividends to be improper unless the original dividend declaration could be proved illegal. Chicago insists that the stocks sell ex dividend.

New York Curb's securities committee ruled to the contrary and refused to quote the stocks ex dividend. Due bills must be attached to constitute good deliveries.

The company's action was taken to conserve cash assets, it being stated that while earnings for the first quarter were less than anticipated the affairs of the organization were in good shape.

▼

Electrical Men Become Members of Radio-Keith-Orpheum Staff

At a recent meeting of the board of directors of the Radio-Keith-Orpheum Corporation Merlin H. Aylesworth was elected president to succeed Hiram S. Brown, resigned. Mr. Aylesworth will continue as president of the National Broadcasting Company. David Sarnoff was re-elected chairman of the board of directors of the Radio-Keith-Orpheum organization and chairman of its executive committee. Owen D. Young, a member of the board, was elected a member of the executive committee. Gerard Swope, president of the General Electric Company, and Andrew W. Robertson, chairman of the board of the Westinghouse Electric & Manufacturing Company, were elected as members of the board and of the executive committee.

▼

Western States Utilities Goes Into Receivership

Receivers were appointed at Wilmington, Del., this week for the Western States Utilities Company of Portland, Ore., allied with the Tri-Utilities Corporation, also in receivership. The Western States Utilities supplied electricity, gas and water to small communities in Idaho, Utah and Wyoming.

United Light & Power to Revise Set-Up

The United Light & Power Company, in completing plans to meet in full the maturity of $11,000,000 bonds due on June 1, which is the only important maturity of the system in more than five years, has also consummated plans for a simplification of corporate structure which will result in early elimination of at least one intermediary holding company.

The first step in this program was the acquisition from the Poston Estate of the Adams County group of properties in southern Ohio and acquisition of virtually the entire minority interest in the United Ohio Utilities Company, also owned by the Poston interests.

The United Ohio Utilities Company and its subsidiaries, in the reorganization, has been transferred to the Columbus Railway, Power & Light Company, together with the Adams County properties, and eventually will be merged into the Columbus company and liquidated.

In a further intercompany transfer of properties the United Light & Power Company has sold the directly owned People's Gas & Electric Company of Mason City, Iowa, to the Kansas City Power & Light Company.

The basic reason for these transfers was to place within a single operating company properties that formerly came under separate operating control, in the interest of economies. Further rearrangements are contemplated.

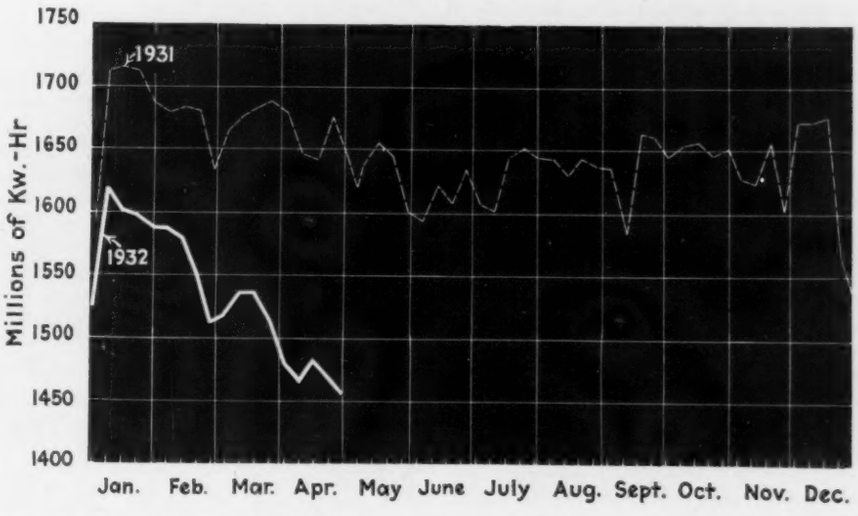
▼

Brooklyn Edison Reports Record Gross Revenue

According to the annual report for the year 1931 gross revenue of the Brooklyn Edison Company amounted to $48,041,050, the highest on record, as compared with $45,947,565 in 1930, an increase of 4.55 per cent. Expenses and taxes were $26,513,027, against $24,666,632, and depreciation $4,551,408, against $3,762,460, leaving operating income of $16,976,615, as compared with $17,518,473, a decrease of 3.09 per cent. Under its employees' profit-sharing plan the company appropriated $980,719 in 1931, compared with $833,096 in 1930.

▼

Normal Change in Output



ENERGY output of electric light and power plants was about 1 per cent less during the week ended April 30 than during the preceding week, but increased slightly compared with 1931, being down 11.5 per cent against 12.3 per cent the week before, according to the National Electric Light Association.

The decrease can be fully accounted for by the normal seasonal change, as nearly as that can be ascertained from the available data, which cover only the preceding four years. In each of the past two weeks the output has been 10 per cent less than the average for the corresponding week during that period. The conditions have not changed, either for better or for worse.

As will be seen from the table there was a slight relative decline in New England, but an appreciable rise in the Mid-Western industrial region, notably in the Chicago district and the Far West.

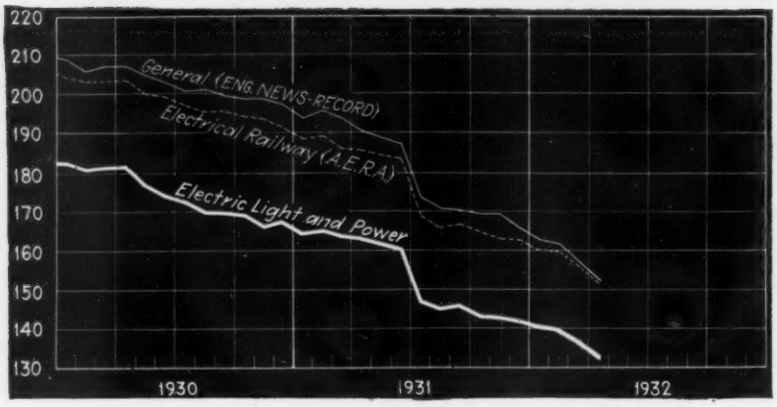
Weekly Output, Millions of Kw.-Hr.

	1932	1931	1930	1929
April 30	1,455	1,644	1,698	1,688
April 23	1,470	1,676	1,725	1,700
April 16	1,481	1,641	1,733	1,709
April 9	1,465	1,647	1,715	1,697
April 2	1,480	1,680	1,708	1,663

Per Cent Change from 1931

Region	Week Ended April 30	April 23	April 16
Atlantic Seaboard	— 8.5	— 8.9	— 3.0
New England alone	—10.9	— 9.4	— 5.3
Central industrial	—15.8	—17.3	—13.5
Chicago district	—10.6	—14.8	— 9.7
Pacific Coast	— 9.1	—11.8	—12.9
United States	—11.5	—12.3	— 9.8

Construction Costs Declining



CONSTRUCTION costs in electric light and power, as in other classes of building, continue on their downward path. The April index is 3 per cent lower than the one computed for the preceding month and 6 per cent compared with January. The reduction from the corresponding month of last year, 10 per cent, is less severe than it was in March, because of the sharp drop in the spring of 1931.

For comparison the chart gives a similar index for electric railway construction and the *Engineering News-Record* general construction index. Each of these declined about 3 per cent from March to April.

Construction Cost Indices: Electric Light and Power, Electric Railway and General

Base 1913 = 100

	Electric Light and Power*	Electric Railway*	General—*Engineering News-Record*
April, 1932....	132	151	153.1
March, 1932...	136	156	157.2
February, 1932	141	159	161.8
April, 1931....	163	186	191.6
Last 5 yrs' high	184	206	210.4
Month.....	Apr. '29	Nov. '28	Feb. '29
Last 5 yrs' low.	132	151	153.1
Month.....	Apr. '32	Apr. '32	Apr. '32

*Computed by Albert S. Richey.

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Illinois Power & Light Has Satisfactory 1931 Record

Despite generally adverse business conditions, the record of the Illinois Power & Light Corporation for the year 1931 was relatively satisfactory. Gross revenues of the electric department were $19,045,352, as compared with $19,465,004 in 1930, a decrease of only 2.2 per cent. Revenues from residential sales increased but 2.4 per cent, as compared with the 8.4 per cent increase in kilowatt-hour sales. This is explained by the fact that the increase in the use of electricity for household purposes has resulted in reduced costs per kilowatt-hour to the customers, as have also the rate reductions which have been made voluntarily by the company.

The 1931 decrease in output of 3 per cent indicates that the business of the company was somewhat better than the average for the industry in the country as a whole. Sales of energy to large industries were reduced 8.4 per cent. Commercial customers used slightly less energy in 1931 than in 1930. These decreases were largely offset by an increase of 8.4 per cent in sales to residential consumers.

Consolidated gross revenues from operations were $34,475,209, as compared with $37,122,937 in 1930, a decrease of 7.1 per cent. Total operating expenses, including maintenance and taxes, dropped from $20,065,434, to $18,238,567, this reduction of $1,826,867 offsetting the loss in revenue.

The loss of approximately $1,000,000 in surplus at the end of the year as compared with the preceding year is probably accounted for by the payment of $2,850,000 dividends on the common stock.

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Consolidated Gas to Pay United Electric Advance

The Consolidated Gas Company of New York has applied to the Public Service Commission for authority to issue $30,000,000 of 5 per cent 25-year gold debenture bonds. From the proceeds $6,200,000 will be applied toward the liquidation of advances from the United Electric Light & Power Company, a subsidiary.

▼

Line Material Net $104,000

For the year 1931 the Line Material Company reported net income of $104,368, as compared with $299,472 for the preceding year. These earnings, which are given after deducting federal and state income taxes, amounted to 48 cents a share for 1931 and $1.39 for 1930.

Sales in 1931 were $3,216,761, as compared with $4,515,968 in 1930, a decrease of $1,299,208, or 40 per cent. Net income before depreciation and income taxes available for bond interest was over seven and a half times the requirement. Net working capital totaled $1,568,413, as compared with $1,627,651 at the beginning of the year, a decrease of $59,238. The ratio of current assets to liabilities increased from 4.7 to 1 at the beginning of the year to approximately 7 to 1 as of December 1, 1931.

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New Utility Issues Total $43,500,000

NEW offerings by the electric light and power companies during the month of April amounted to $43,500,000, as compared with $40,000,000 in March and $203,000,000 in April, 1931. For the four-month period the total recorded this year is $144,300,000, against $589,314,000 for the similar period of 1931. Although public utility financing is running far behind last year, it is holding its own, comparatively speaking. Not a single industrial issue appeared in April, the seventh month since any bonds were floated for that group.

It is interesting to note that the Edison Electric Illuminating Company contributed $30,000,000 to the April total in the form of short-term notes:

Name of Company	Amount of Issue (Par Value)	Period (Years)	Class	Purpose	Interest Rate	Price	Per Cent Yield
Kansas City Power & Light Co.....	$5,250,000	29	First mortgage gold bonds.....	To reimburse for additions and for other corporate purposes.....	4½	92.37	5
Columbus Railway, Power & Light Co.	4,500,000	10	Secured convertible gold bonds ..	To retire maturing bonds, to reimburse for additions and for other corporate purposes.....	5½	94	6.31
Edison Electric Illuminating Co of Boston.....	10,000,000	1	Coupon gold notes.....				
	20,000,000	3	Notes.....	To meet maturing notes.....	4½	99.76	4.75
					5	98.79	5.44
Narragansett Electric Co.....	3,750,000	25	First mortgage gold bonds, series B.....	Additions, extensions and to retire notes.....	5	93¼	5.50
Total.....	$43,500,000			Rights.....			
Total amount actually realized...	42,310,300			Total financing.....	$42,310,300		

Westinghouse Orders Drop 32 per Cent in Quarter

An analysis of the figures contained in the quarterly statement of the Westinghouse Electric & Manufacturing Company shows that the organization is holding its own, that some significant items show a marked improvement and that the results of management economies are bringing about the readjustment made necessary by present business conditions. For instance, while the gross earnings have dropped about 28 per cent from those of the first three months of 1931, the net loss is 54 per cent less than for that period.

Improvement also is noted in unfilled orders, which were $36,598,246 March 31, 1931, and $37,999,565 March 31, 1932. Net inventory shows a favorable reduction, having been cut from $43,299,442 March 31, 1931, to $37,511,827 March 31, 1932.

Orders entered during the first quarter of 1931 were $30,100,410. This figure for the corresponding period of 1932 was $20,388,658.

Net loss of the combined companies in the first quarter this year was $1,320,148, or $1,565,797 less than the loss for the same months of 1931, despite the fact that net sales billed or gross earnings dropped from $28,476,175 to $20,377,948.

▼

General Electric Organizes Air-Conditioning Department

The organization of an air-conditioning department within the General Electric Company, which will market various electrical devices for home heating, humidifying and temperature control, has been announced by President Gerard Swope. One of the first products to be marketed by this new department will be a complete oil-burning furnace.

J. J. Donovan of Cleveland, formerly in charge of apartment house refrigeration sales, will be manager. Associated with him will be E. D. Harrington of Schenectady, in charge of application engineering; J. R. Rue of Pittsfield, in charge of manufacturing, and H. S. Woodruff of Schenectady, in charge of design engineering. Headquarters will be maintained at General Electric's New York offices, 120 Broadway.

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Big Decline in British Electrical Combine's Profits

Stockholders in Associated Electrical Industries, the British electrical combine, have received a disappointment in the reduction of the ordinary dividend to 4 per cent for 1931, compared with 6 per cent for 1930. The disbursement requires about £57,700 ($288,500) less than the payment for 1930, and as the forward balance is reduced from £110,410 ($552,050) to £99,899 ($459,495), the shrinkage in net profit has evidently been severe.

The directors explain that the results were arrived at after charging against profits all losses incurred on exchange during the year. The net figure after such charges and after adjusting reserves is £284,829 ($1,424,145), a decrease of £88,168 ($440,840). The combine controls the British Thomson-Houston Company, Metropolitan-Vickers Electric, Edison Swan, Ferguson Pailin and various other undertakings in Britain and abroad.

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Westinghouse Concentrates on Household Appliances

In opening the Westinghouse National Sales showroom to display electrical household appliances, 200 Fifth Avenue, New York City, the Westinghouse Electric & Manufacturing Company is ready to show architects and builders all of the recent electrical household developments in the building field, also department store buyers, public utility executives and other large distributors of electrical household equipment how they can increase their sales volume in this line of merchandise.

This showroom will display all of the latest Westinghouse electrical household equipment, ranging from electric refrigerators and electric ranges to automatic electric irons and fans. The equipment is arranged so as to demonstrate how to get the most efficient use of all of the appliances shown. There are three complete kitchens equipped with electric refrigerators, electric ranges and all of the other latest Westinghouse electrical household appliances. These installations also include ventilating equipment and a special treatment and arrangement of ceiling and walls so that the best possible result from the modern lighting equipment can be obtained.

Robert J. Alexander, who is in charge of the Westinghouse National Sales showroom, is manager of the company's retail distribution department. He has been connected with the house-furnishing department of some of the largest department stores in the United States.

In addition, Westinghouse employees are being mobilized to promote a national campaign, the slogan of which is "Every employee to sell one or more Westinghouse household appliance during May." The employees themselves are responsible for the unusual idea. They will offer no discounts and will receive no commissions from the company. All sales will be made through established Westinghouse dealers, whose salesmen will co-operate with employees in closing sales on the large appliances. A national organization has been set up to reach acquaintances of the employees. These constitute several million "prospects" are ordinarily beyond the reach of the regular sales force. The executives of the company have entered into the spirit of the campaign and have pledged themselves personally to sell appliances during May.

Major New Construction This Week

ELECTRIC power equipment, including heavy machinery, generating and distributing apparatus for power plant and harbor construction service, estimated $200,000, will be purchased by Frederick Snare Corporation, New York, for a $2,850,000 harbor development contract at Cartagena, Colombia.

Motors and controls, machine drives, panelboards and instruments, conduits, etc., will be installed in $100,000 plant addition for Cummins Engine Company, Columbus, Ind.

Complete electrification of copper-mining plant in Swain County, North Carolina, planned by North Carolina Exploration Company, Fontana, N. C., with installation of transformers and other power substation equipment, motors and controls, conveyors, etc.

Machine drives, motors and controls, panelboards and instruments and auxiliary electrical equipment will be installed in the $200,000 plant to be constructed at Hoboken, N. J., by Hinde & Dauch Paper Company, Sandusky, Ohio. Similar electrical equipment will be installed in another new plant unit of same company at Winston-Salem, N. C., to cost over $100,000.

Until May 17 Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for turbo-generator sets, accessories and spare parts for Eastern or Western yard (Schedule 7924). Also, at same time, bids for 41,600 ft. of lighting and power cable for Western yards (Schedule 7965).

Electric evaporators, separators, washing machines, conveying equipment, refrigerating machinery and other electrical equipment will be installed in the $100,000 milk condensory to be constructed at Lagrange, Ind., by Gordon Baking Company.

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New York Metal Prices

	April 27, 1932 Cents per Pound	May 4, 1932 Cents per Pound
Copper, electrolytic	5.75	5.75
Lead, Am. S. & R. price	3.00	3.00
Antimony	5.35	5.30
Nickel, ingot	35.00	35.00
Zinc, spots	2.95	2.90
Tin, Straits	19.45	22.25
Aluminum, 99 per cent	23.30	23.30

Public Ownership for Milwaukee?

Surveys are being conducted by J. P. Schwada, city engineer of Milwaukee, to determine whether it would be cheaper for the city to construct its own electric plant to serve public institutions. A sweeping Socialist victory in the recent city elections has started a campaign for public ownership of all utility services, and Mayor Hoan has asked the Common Council to make recommendations on the matter.

▼

More Strife in Los Angeles Board

Separate management of the water and power bureaus of the Los Angeles Department of Water and Power is recommended in a report filed April 27 with the City Council by a special committee which charges mismanagement by a so-called "majority group." It condemns this group for combining the Bureau of Power and Light with the Water Bureau, for subordinating the authority of E. F. Scattergood, chief electrical engineer, and for diverting power revenue funds to pay for St. Francis Dam bonds.

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Extending Service from Bagnell

Formation in Missouri of the Lake Side Light & Power Company as a subsidiary of the Union Electric Light & Power Company is announced. The new company is intended to distribute energy from the Bagnell hydro-electric plant in the Ozarks to a large portion of Miller, Morgan, Benton and Camden Counties. In the lake district, designed for a summer resort, $450,000 will be expended for light and power facilities and as much more for roads and drives.

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Hydro Plants for the Big Miami?

H. S. Hunt, president of the Fargo Engineering Company, Jackson, Mich., has, it is reported, recently conferred with city officials of Hamilton, Ohio, and adjoining towns in connection with a project to construct a series of hydro-electric plants on the Big Miami River south of Middletown, in that state. The proposed plans call for an expenditure of $6,000,000.

▼

Brooklyn Edison Rate Hearings End

Rate hearings before the New York Public Service Commission on contested classifications of the Brooklyn Edison Company were closed on April 29 with testimony from President John C. Parker. The case took more than six months to present. The theaters and department stores which are the complainants in the case charge the Edison with discrimination and request a readjustment to permit a lower cost for high load factors. The Edison company contends that the suggested changes in the schedules would cause the company an annual loss in revenue of $500,000 without benefit to the consumers.

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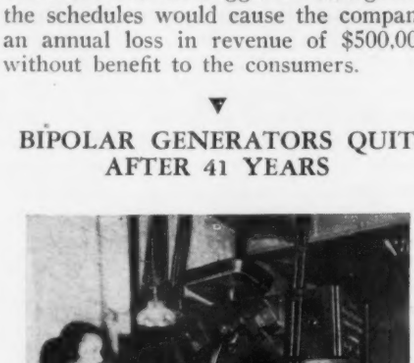
BIPOLAR GENERATORS QUIT AFTER 41 YEARS



—*Wide World Photos*

Henry Ford has made a bid for three 60-kw., 120-volt generators built by the General Electric Company in 1891, after Edison's design, for the Mills Building, San Francisco, where they have just "knocked off" working.

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St. Lawrence Treaty Halts

Officials of the New York State Power Authority were in Washington last week urging the State Department to speed negotiations with Canada on the St. Lawrence waterway. Fear is entertained that the adjournment of Congress and the Canadian Parliament may delay the consummation of a treaty another year. No official comment was available, but a report from Canada says the treaty is nearly ready.

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Eagle Pass (Tex.) Hydro Plant Ready

The 12,000-hp. hydro-electric plant of the Central Power & Light Company at Eagle Pass, Tex., built on the main canal of a new irrigation system, is now complete. The contract provides that the irrigation district shall provide the company with water for power purposes, the company to pay $275,000 annually for the use of the water for a period of ten years and to pay to the district $250,000 a year for the next 30 years.

Upstate Utility Fights Metropolis

Objections to New York City's proposed reservoir and power plant at Rondout Creek, Ulster County, made by the Central Hudson Gas & Electric Corporation, were heard recently in the Court of Appeals. The city wishes to withdraw 50,000,000 gal. of water daily between October 1 and June 30 each year and to erect a power plant near High Falls on the creek. This, the Central Hudson company asserts, will greatly diminish its power to supply electricity to residents in the Hudson River valley. The point of law involved is whether land already put to public use can be condemned for another public purpose without specific statutory authority.

▼

Receiver for Texas-Colorado Dam

Assent to a receivership for the Hamilton Dam project on the Colorado River in Texas (ELECTRICAL WORLD, April 30, page 759) has been given by the Central Texas Hydro-Electric Company. The company is solvent, according to a recent statement, and the receivership has been asked to conserve its assets. The application said that the work of construction is about 50 per cent completed.

▼

St. Louis Dispute to Federal Courts

A motion to transfer the litigation instituted by the Union Electric Light & Power Company against the Laclede Power & Light (ELECTRICAL WORLD, April 16, page 676) to the United States courts was granted at St. Louis last week on the application of Harley L. Clarke and two other Laclede officials on the ground that they are residents of Chicago. Depositions concerning the purchases into Laclede by North American Company officials in New York, including information on the organization of the Securities Investing Trust of Massachusetts, apparently for that purpose, by Chairman Dame and President Gruhl, were filed.

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Ohio Utility Reorganized

In a reorganization approved by the Ohio Public Utilities Commission the Scioto Valley Railway & Power Company of Columbus has changed its named to the Ohio-Midland Light & Power Company.

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Contracting Situation in New York

A group of New York City electrical contractors met last week and rehabilitated the Electrical Contractors' Association, which was split three years ago because of disagreement concerning its policy toward the demands made by the

electrical workers' union. As a result of the dissension in 1929 one group of contractors made an agreement with the union to pay 20 cents an hour for each workman in order to provide insurance for the union members. Other employers did not join the association and refrained from making the payments into the insurance fund. It is said the insurance scheme is likely to be abandoned. The new contractors' association will be headed by J. P. Ryan of the Keresey-Ryan Corporation (ELECTRICAL WORLD, March 19, page 517.)

▼

Utility Divisions Must Stand Each on Own Feet

A recent decision by the Wisconsin Supreme Court is in line with previous court findings in various states, as well as with many decisions of state commissions, in holding that separate units of utilities comprising more than one division must earn their own way without support from more prosperous divisions. The decision reverses a contrary policy on the part of the old Wisconsin Railroad Commission, which refused to grant an increase in fares high enough to meet a deficit in the street-railway operations of the Milwaukee Electric Railway & Light Company, thus, the company maintained, compelling it to continue to use part of its earnings from its electric light and power business to make up the deficiency. The finding reversed that of the Circuit Court sustaining the commission. The Supreme Court said:

There is no provision in the statutes creating the Railroad Commission which expressly or by implication authorizes the commission, in prescribing regulations and rates for railway transportation which fail to net reasonably adequate returns upon the value of the railway's property involved, to compel the owner thereof to use its earnings from other public utility operations to meet a deficit incurred in its railway operations.

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Ten-Cent "Mazda" Lamps Are Soon to Be Offered

New "Mazda" lamps in standard sizes to retail for 10 cents are soon to be on the market. These lamps are based on 500-hour life instead of the 1,000-hour life of present lamps. In other respects they will be of the same quality as existing "Mazda" lamps.

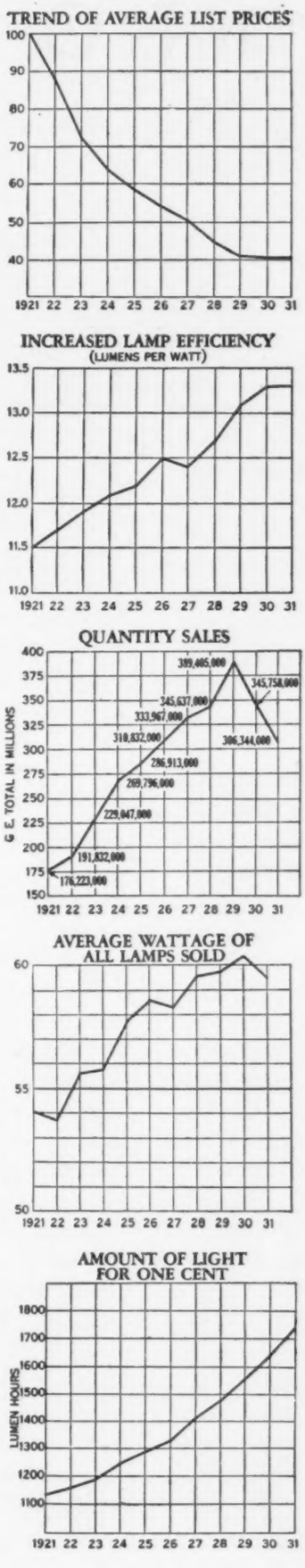
These shorter-life lamps are designed for chain and department store sales and will meet the competition of inferior but low-priced domestic and imported lamps. This competition has become serious, and, outside of this, there is a market demand for a cheaper, shorter-life lamp. The new lamps are not to take the place of the standard 1,000-hour "Mazda" lamps now sold but are supplementary to these lamps.

The efficiency of the new lamps will be as high as, if not higher than, that of existing "Mazda" lamps, and the 500-hour rating makes the drop-off in illumination at the end of normal use more abrupt. It is felt that the replacement problem will be handled adequately and that the larger number of sales of the lamps will make their distribution profitable for the sales outlets.

There is likely to be much comment as to whether empty sockets will increase, whether the lower-priced lamp will soon monopolize lamp sales and whether the move of the lamp manufacturers is wise. The fact remains that after a thorough study of the situation the new lamp is about to be marketed. A formal announcement is expected in the near future.

The accompanying charts were incorporated in a General Electric Company statement to stockholders dated April 25, 1932.

Decade of Progress in Lamp Industry



Code Revision Sought for Domestic Breakers

At the suggestion of the National Electrical Manufacturers' Association the National Fire Protection Association has submitted to its members and co-operating bodies a proposed revision for the National Electrical Code which if approved for adoption will permit the use of circuit breakers in the branch circuits of single-family residences without a main-service switch and cut-out, in the manner permitted with apartment houses by Section 405-b2.

In suggesting the change A. B. Smith of the N.E.M.A. pointed out:

We now have a field experience of three years with circuit breakers approved for entrance and branch circuit work. More than 200,000 circuits have been installed with no record of failures. In addition several hundred installations have been made in single-family residences with the overload protection consisting of an assembly of circuit breakers at the point of entrance. These installations have been made with local approval, have a satisfactory performance record and were made without separate entrance switch and fuse or equivalent circuit breakers. Since the principle of individual switch and cut-out or circuit-breaker protection for a limited number of circuits has been recognized without limitation of service capacity in apartment house wiring since 1928, with no adverse record, we are requesting recognition of this same principle to a smaller number of circuits with limited capacity in the single-family residence.

The specific omission suggested in 405-b-2 is: "The switch and fuses may be omitted in service." The rule as amended, therefore, would require the installation of the entire distribution center at the point of entrance.

EDITORIALS

L.W.W.MORROW
Editor

A professor sums up

BELIEVE it or not, one professor exists who sees good in the dark picture of the electrical industry that has been painted by so many of his academic confrères. All cannot be black and nefarious about a nation-wide enterprise that has added to national wealth and the captured fruits of pursued happiness many times what it has cost in capital allocation and annual expenditures for the product. That's what Prof. Philip Cabot of Harvard proves in an article in *World's Work* for May.

First he asserts that the unfoldment of the electrical era would have been delayed a whole generation unless the holding-company mechanism had been injected to accelerate the development and the integration. That delay would in turn have retarded the creation of national wealth by billions of dollars. At least one-eighth of the industry's patrons have saved a good $1,000 a year each on wages for domestic service by spending a comparatively negligible amount for energy used by labor-saving devices. That saving alone more than pays the nation's whole electric power bill. Everything that has ever been invested in the industry, even if you are pessimistic enough to declare it vanished at today's low security prices, is more than offset by the enormously enhanced productiveness of industrial labor. The American public can well attribute its enjoyment of automobiles, radios and all other indices of an elevated standard of living to the purchasing power that came with an industrial efficiency founded on cheap electric power.

Professor Cabot raises another question that should confound some of the political critics of the industry. He says the price and quality of the service *must* have been satisfactory to the buyers during all this period. No one *has* to buy electricity. If he does buy it, and on a phenomenally increasing scale at that, it is because he feels he is getting more than his money's worth. Evidence the public sentiment about automobiles, radios, amusements in this particular. The statistical sharks have a challenge here to extend the professor's figures and show that the American public has reaped an alluringly high dividend on every cent it has committed to electrical development. As a nation we can write off the whole outlay by drawing upon our huge surplus of benefits that have come out of the enterprise. Best of all, we still have our plant unimpaired to give us undreamed-of returns in the future. All future benefits are velvet.

Improved conditions for financing

AGGRESSIVE release of credit by the purchase of government bonds in the open market by the Federal Reserve promises to permit utility financing as an incidental benefit. Member banks will first pay off their indebtedness to the Federal Reserve, and the success of the action will then depend upon the inducement it gives to an extension of member bank loans and security purchases, which have been declining at a rapid rate.

Banks have been reluctant to increase their holdings of corporate securities during this year and in fact have been increasing their holdings of government bonds and divesting themselves of corporate bonds. As the Federal Reserve operations tend to raise the price and lower the yield on government issues there will be a relative increase in the investment demand for corporate issues. The splendid showing of the utilities at this time should bring them favor and thus enable

the industry to issue securities in normal volume in order to expand the business. This is a necessary step to a revival of utility buying.

The status of the local leagues

LAST year the special joint committee of the National Electrical Manufacturers' Association and the League Council issued approval certificates to the leagues of twenty-two cities. This joint committee has undertaken, in behalf of the industry, the responsibility of reviewing the activities of local electrical leagues and checking their financial status. For the information of the industry, it certifies to the fact that a league is deserving of support, based on the nature of its activities and on two conditions of its financial set-up. First, it is required that at least one-half the budget must be underwritten by the local utility as a guarantee of power-company co-operation and support. Second, the overhead expense of the league must not exceed 20 per cent of the entire budget. On the strength of this certification the N.E.M.A. publishes a list of approved leagues, and its members are expected to restrict to these organizations their cash subscriptions to local co-operative work.

There are operating in this country today in the neighborhood of 120 local co-operative organizations of electrical men that call themselves leagues or clubs or associations. That so large a proportion of them fail to qualify under the requirements of this joint committee is due to the fact that many of them are very limited in their activities and that in other cases the local power companies are not participating sufficiently in this work both in money and man power to insure an adequate measure of good results.

The twenty-two approved leagues last year spent a total of $788,000. No figures are available covering the aggregate expenditure of all these local groups, but it is estimated at about $1,000,000. It is a sum too large to be spent with so small a minority qualifying under this very liberal industry requirement. And yet in proportion to the value of local co-operation in the development of the electrical market, it is a modest sum.

The progress of the refrigeration campaign and the promise of the electric range campaign that is now being launched impress anew upon all electrical men the very vital importance of harmony and organized purpose in local selling. More leagues are needed. But they must be sound in concept and in policy. They must have sufficient strength to set up programs and to carry out their plans, to inspire confidence and to exercise leadership.

Cheap insurance for pedestrians

VEHICULAR traffic on highways grows constantly in volume, with increasing speed and density of flow. If commercial vehicles are to be operated profitably, there can be no turning backward to slower days and nights, and pleasure cars must also move out of the way swiftly to prevent congestion. Appalling lists of fatalities to pedestrians challenge public works engineers and legislative bodies to provide higher standards of visibility for night travel. In traffic engineering circles the belief is growing that headlights on a vehicle moving faster than 35 miles per hour provide an insufficiently clear silhouette of a pedestrian ahead of the approaching driver when the walker is crossing or passing along traffic lanes. Inadequate highway lighting encourages the motorist to increase his car speed and cuts down the chances of a safe crossing, especially where traffic speeds through lanes in opposite directions.

Attention has been concentrated on the problem of passing vehicles through particular road sections and districts with minimum loss of time. Traffic signal engineering has forged to the front in this connection with much good accomplished. In many cases, however, the approaches to signal points have become subjected to faster car and truck movement than before on account of the desire of each driver to pass the signal before it turns against him. Reliance upon headlight illumination is often hazardous in comparison with proper installations of fixed lighting units on the thoroughfare in question. The pedestrian should not be subjected to the danger of becoming confused in judging the distance of swiftly approaching vehicles projecting powerful beams of light in his direction, and, on the other hand, the motorist should be assured of receiving a sharp silhouette of the pedestrian on the roadway in ample time to avoid accident.

In many cases proper highway lighting will

obviate the need of constructing pedestrian underpasses. It always contributes toward the reduction of law violations. The safety of the pedestrian is being considered of basic importance in campaigns like those of the American Legion and the National Bureau of Casualty and Surety Underwriting now being inaugurated, and what insurance better and cheaper than improved highway lighting is available against injury to those who ride and those who walk under present and prospective traffic conditions?

Instantaneous reclosure for service

INSTANTANEOUS reclosure of the system circuit breakers is the next move in the industry's march toward perfection in service continuity. Most of the troubles that kick out breakers are transitory. One investigator has reported that in 85 per cent of the cases the breaker stayed in on the first reclosure. Another believes his system would support 95 per cent stay-ins on immediate reclosure. Test shorts on a mill feeder left the customer unaware of any interruption; his induction motors did not drop appreciably in speed while the breaker was out.

But many questions must be answered and many problems solved before instantaneous reclosure can become prevailing practice and full advantage be obtained from its possibilities. These involve the subjects of circuit-breaker mechanisms, protective relaying, circuit-breaker ratings, motor-control equipment, and probably in some cases modifying features of motor-driven equipment.

It goes without saying that the ramifications of this problem should be explored in the early future. Regardless of the speed with which the technical attack within the industry is undertaken, there is the more pressing problem of educating the motor-using public to the understanding that, as in the case of power-factor correction, the provision of superlative continuity of service is something demanding a contribution on its part. Motor-driven equipment manufacturers must also be convinced. Time delay on the undervoltage motor releases is an inherent part of the answer. But even before these things can be done intelligently more must be known about the general run of motors and load characteristics in order to establish and publicize proper values of time in which to clear and re-energize the power circuits.

Patent revision and the engineer

NEWSPAPERS have been telling a bit facetiously of the antipathy of Representative Sirovitch toward metropolitan dramatic critics who find little on the stage to applaud. The patents committee of the House, of which Mr. Sirovitch is chairman, is, however, less ostentatiously engaged in a task of reframing our patent laws as well as those which protect the copyrights of authors, composers and playwrights. Here the engineer has an interest. That interest is being represented actively by the American Engineering Council.

What will happen to the proposals in the ultimate bill is of course problematical, but the nation's inventors should be no less attentive to these evolutionary changes than the patent and corporation attorneys of the American Bar Association. In general, several of the moves proposed are aimed at circumventing the long delays in patent grants and litigation. One scheme, not unanimously favored, would give the Commissioner of Patents authority to afford publicity to patent applications after the present three-year period has elapsed. Another would assure fuller relinquishment of rights to the assignee and thus expedite clarification of the technique of infringement and similar matters. Still another provides that an inventor shall lose all rights of demonstrating priority of invention beyond a period of two years antedating his application. Patent renewals may also be dropped.

Patenting of mere discovery, as distinct from invention, may be confirmed. If a horticulturist can patent the production of a new variety of plant by a sexual process, why should not the discoverer of a useful property of nature be similarly rewarded? Perhaps the isolation of the neutron or the identification of cosmic rays is to be patentable. In that event should governmental and university scientists be permitted to retain a larger interest in patentable discoveries made in the course of their employment?

All these topics and more are under discussion. Engineers will do well to familiarize themselves with what the American Engineering Council is doing to sustain their professional prerogatives. The legislation should not hinge alone on what the bar association deems advantageous for preservation of the rights of the inventor to whatever intrinsic value his brain children may have.

Frank Truman Post

AMONG the "elder statesmen" of the light and power industry is Frank T. Post, who after a legal career of 41 years in Spokane, Wash., became president of the Washington Water Power Company in 1930. He had been affiliated with the company as legal counsel for 21 years and had also been a vice-president for many years, so that his entry into the office of president was a natural transition and served to perpetuate a tradition of leadership by men familiar with the territory which the company serves.

Mr. Post was born in West Potsdam, N. Y., in 1862, was graduated from St. Lawrence University in 1883, and was admitted to the bar of New York State in September, 1885, following which he took a special course in the Harvard Law School. He practiced for several years in Lowville, N. Y., but in 1889 decided to try his fortunes in the West. Stopping off at Spokane, then a thriving pioneer town, he was persuaded to remain.

Mr. Post's record in his adopted community is notable. He has been corporation counsel of the city of Spokane, president of the Spokane County Bar Association and president of the Washington State Bar Association. He formerly was president and general counsel of the Home Telephone & Telegraph Company of Spokane. He was made legal counsel for the Washington Water Power Company in 1909, and in the succeeding years, as its general counsel and later as its vice-president and director, he became thoroughly familiar with the whole public utility field.

Mr. Post embodies the spirit of the Western pioneers. The door of his office always stands open, and in his long career at the bar and his close contact with the industrial, mining, political and social life of the Spokane country he has become widely known for his democratic attitude and his genial humor. He has a firm faith in the future of the electrical industry and is enthusiastic about its further development under private initiative. Since becoming president of the Washington Water Power Company his record has been one of close co-operation with the communities which the company serves. His policies are predicated on the future. "Faith in the future," he declares, "is the greatest buoy a man can find for his welfare and spirits. Confidence is the keystone of a community or of an individual."

Overhead Secondary Network Offers Real Economy

By JOHN S. PARSONS and LEONARD M. OLMSTED

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Westinghouse Electric & Manufacturing Company,
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THE low-voltage a.c. network system is the most economical means of supplying the exceptionally high grade of service required in downtown areas of the larger cities. Until now it has not been feasible to secure the same reliability of service in the lighter load density areas, where overhead secondaries are used, because of the high cost of the overhead a.c. secondary network system when compared with other types of distribution systems which will usually give adequate, although not as good, service. A large part of the expense of the overhead secondary network system has been due to the relatively high cost of the available network protectors which are required with each transformer installation on the system. An expensive network protector means that the economic size of transformer bank is quite large. These large banks must be spaced a considerable distance apart, and as a result large and expensive secondary network mains must be used.

But recently a line of small air breakers embodying the Deïon principle has been developed which will be completely tool manufactured in large quantities. With these small, inexpensive Deïon breakers available to serve as a nucleus it has been possible to develop a line of compact, light-weight, low-cost network protectors applicable to overhead a.c. low-voltage network systems. When using these new protectors a smaller size transformer bank becomes economical. This means that in a given area the banks will be spaced closer together and smaller and less expensive secondary mains can be used in the network. The secondary network thus acquires economic potentiality.

An extensive cost analysis has been made comparing

Overhead Secondary Network Saves Mo

(Study based on 4 mile square of uniform load de

	4-Kv. Radial Distribution System, All Circuits Open Wire				13.2-Kv. Radial Distribution All Circuits Open Wire				4-Kv. Primary Network All Circuits Open Wire				Overhead Secondary Network All Circuits Open Wire				4-Kv. Radial D tribution Transm and 4-Kv. Un ground, Secon Open Wire	
System load, kva. per sq. mile	750	1,500	3,000	4,500	750	1,500	3,000	4,500	750	1,500	3,000	4,500	750	1,500	3,000	4,500	1,500	3,000
Number of units	....	....	....	....	....	....	....	....	16	29	56	81	....	....	....	....	.....	.....
Secondary conductor size	No. 2	No. 2	No. 2	Av. No. 1	No. 2	Av. No. 1	Av. No. 1	Av. No. 1/0	No. 2	No. 2	No. 2	Av. No. 1	No. 2/0	No. 2/0	No. 2/0	No. 2/0	No. 1/0	No. 1/0
Distribution transformer size, kva	15	Av. 17	Av. 21	Av. 26	15	Av. 18	Av. 25	Av. 29	15	Av. 17	Av. 21	Av. 26	30	Av. 35	Av. 40	Av. 45	30	Av. 31
(Costs in thousands of dollars)																		
Transmission within area	23	59	113	157	221	229	296	342	44	83	127	159	106	145	275	332	270	707
Substations	362	780	1,470	2,260	....	....	....	....	....	....	....	....	....	....	....	....	780	1,470
Distribution transformers and accessories	525	946	1,630	2,110	1,100	2,060	3,195	4,310	525	946	1,592	2,110	915	1,720	2,750	3,911	1,082	2,140
Distribution units	....	....	....	....	....	....	....	....	464	841	1,905	2,750	....	....	....	....	.....	.....
Distribution transformers, protectors and accessories	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.....	.....
4-kv. circuits	404	520	785	924	....	....	....	....	303	320	352	384	....	....	....	....	1,497	2,020
Secondary circuit	330	411	540	805	330	469	804	1,082	330	411	618	805	1,170	1,170	1,170	1,170	725	930
Poles	525	610	745	747	507	553	606	655	546	649	722	795	611	645	755	800	530	640
Ducts and manholes	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5,420	6,350
Changeover expense	33	107	195	246	33	98	161	219	33	107	190	246	2	6	6	6	30	112
Investment in area	2,202	3,433	5,478	7,249	2,191	3,409	5,062	6,608	2,245	3,357	5,506	7,249	2,804	3,686	4,956	6,219	10,334	14,369
Main transmission outside area in excess of secondary network	0	74	148	370	0	0	185	226	0	0	74	74	....	....	....	....	240	1,200
Induction regulators	....	....	....	....	79	153	304	426	0	....	....	....	76	149	254	361	.....	.....
Total investment	2,202	3,507	5,626	7,619	2,270	3,562	5,551	7,260	2,245	3,357	5,580	7,323	2,880	3,835	5,210	6,580	10,574	15,569
Capitalized losses	300	508	1,010	1,350	278	326	596	940	239	410	810	1,180	178	324	609	755	1,004	1,730
Total cost	2,502	4,015	6,636	8,969	2,548	3,888	6,147	8,200	2,484	3,767	6,390	8,503	3,058	4,159	5,819	7,335	11,578	17,299
Cost per kva. of peak load (dollars)	208	168	138	125	213	162	128	114	207	157	133	118	255	173	121	102	482	360

the overhead secondary network system with the radial system and the primary network system. This analysis indicates that the overhead a.c. secondary network system of distribution has certain economic applications.

It is desirable that a fundamental study of this type cover a large area, so as to eliminate as far as possible any effect which the size of the area to be served may have on the comparison. For the purposes of this analysis a square area, 4 miles on a side, has been used. An investigation of the cost of serving irregular areas indicated that any change in total system cost is not great, and will not materially alter the conclusions drawn from a study based on serving a square area. This comparison covers a range of load densities from about 750 to 4,500 kva. (system two-hour peak load) per square mile, where open-wire overhead secondary circuits are usually employed.

The cost of serving the 16-square mile uniform load density area with four distinct types of distribution systems, namely, a 4-kv. radial system, a 13.2-kv. radial system, a 4-kv. primary network system and an overhead secondary network system fed over 13.2-kv. transmission circuits, has been set up in the table. The transmission voltage used is in all cases 13,200, which is probably more common in practice than any other one voltage. It is felt that the use of any other voltage between 11 kv. and 25 kv. will not greatly alter the conclusions. Three general types of transmission have been considered for each system. These are open-wire overhead circuits, aerial-cable overhead circuits and underground cable circuits installed in ducts. The 4,150 volts adopted for primary distribution is widely used and should be entirely representative. In general the 4-kv. primary distribution circuits and the low-voltage secondary circuits have been considered to be open-wire construction, in accordance with common practice. Due to zoning ordinances or other local condition, however, both the 4-kv. circuits and the transmission circuits are sometimes installed underground in ducts. This condition has also been covered in the table herewith. In all cases the distribution transformers are mounted on poles in the usual manner.

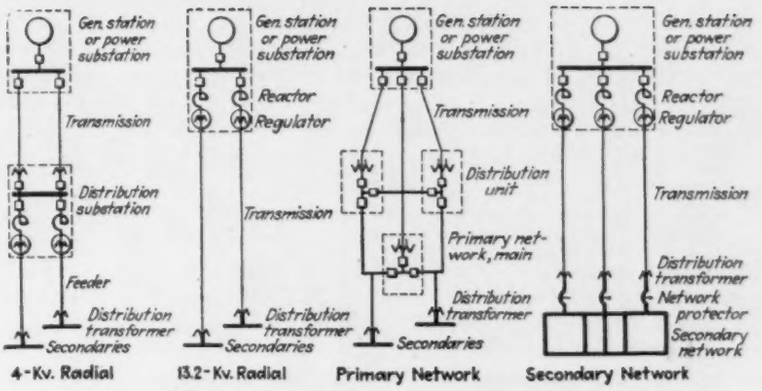


Fig. 1—Types of a.c. distribution systems

Bases for radial estimates

A number of 4-kv. radial systems were laid out and evaluated using different capacity distribution substations, and the one giving the greatest over-all economy for the entire range of densities considered has been used in the comparisons. The substation design calls for all equipment indoors except the transformers and high-tension disconnecting switches and includes underground connections for both high- and low-voltage circuits from the station to the curb line. Additional expense for underground construction to avoid excessive congestion of feeder circuits overhead around the substation has been included as a part of the circuit costs rather than a part of the station cost. The transmission circuits and substation transformers have been treated as a unit. This eliminates all high-tension switching at the substations and thus reduces their cost. A complete spare transmission circuit in excess of load requirements at each substation is provided for emergency operation.

The radial feeder circuits are rated at 200 amp., 4,330 volts, and extend to the load centers, where they divide into two reduced-capacity branches, from which the smaller capacity laterals radiate. Automatic reclosing circuit breakers and 10 per cent buck or boost regulators are installed in each feeder circuit.

Three-phase, four-wire secondaries assumed

The distribution transformers are three-phase units serving three-phase, four-wire, 120/208-volt secondaries. This is admittedly an approximation and was used finally after considerable close observation of distribution systems. In view of the fact that single-phase systems require three wires and are liberally dotted with three-phase power customers on independent circuits, often making six parallel wires for some distance along streets,

Medium Density Areas

ving 10 per cent per year)

Kv. Radial Distribution ansmission Circuits Underground, condary Open Wire			4-Kv. Primary Network Transmission and 4-Kv. Underground, Secondary Open Wire			Overhead Secondary Network Transmission Underground, Secondary Open Wire		
00	3,000	4,500	1,500	3,000	4,500	1,500	3,000	4,500
..	.....	.....	29	56	81	.....	.....	.....
	No.	No.	No.	No.	No.	No.	No.	No.
0	1/0	1/0	1/0	1/0	1/0	3/0	3/0	3/0
	Av.	Av.		Av.	Av.		Av.	Av.
	31	34	30	31	34	45	51	60
53	1,710	2,380	565	950	1,140	1,600	2,320	2,590
..	.....	.....	.....	.....	.....	.....	.....	.....
06	3,340	4,650	1,082	2,140	2,840	.....	.....	.....
..	.....	.....	1,190	2,300	3,320	.....	.....	.....
..	.....	.....	.....	.....	.....	1,940	2,985	4,000
..	.....	.....	1,052	1,142	1,520	.....	.....	.....
25	930	930	725	930	930	1,442	1,442	1,442
50	640	640	530	640	640	641	680	720
20	5,270	7,120	5,340	6,115	8,300	4,760	6,444	6,583
30	112	160	30	112	160	27	56	87
64	12,002	15,880	10,514	14,329	18,850	10,410	13,927	15,372
0	480	720	0	240	240	.....	.....	.....
52	285	426	.....	.....	.....	152	247	342
16	12,767	17,026	10,514	14,569	19,090	10,562	14,174	15,714
08	1,222	1,760	983	1,655	2,320	458	803	1,180
44	13,989	18,786	11,497	16,224	21,410	11,020	14,977	16,894
43	292	261	480	339	298	470	312	235

it is felt that this approximation is permissible. Lightning arresters and fused cutouts are included on the primary side of all distribution transformers where overhead feeders are used.

The average block is assumed to be 330x480 ft. At 750 kva. per square mile all services are supplied from secondaries on poles on the long sides of the blocks. At 1,500 kva. per square mile service is also provided to 50 per cent of the short sides, at 3,000 kva. per square mile to 75 per cent of the short sides and at 4,500 kva. per square mile to all sides of all blocks. The system cost estimates include the cost of all secondary mains, but not the cost of service connections.

In the 13.2-kv. radial system the distribution transformers are fed directly from a generating station or power substation over 13.2-kv. transmission circuits without any intervening voltage transformation. Manually operated sectionalizing switches are provided so that when a fault occurs on a transmission circuit the load on the unfaulted sections of the circuit can be picked up on adjacent circuits. Each transmission circuit is rated at 6,000 kva. and normally loaded to about 75 per cent of this value so as to provide the necessary spare capacity. In this way the amount of load dropped until repairs can be made is kept to about the same value as that which is dropped when a faulty feeder is tripped in the 4-kv. radial system. Induction regulators providing 5 per cent buck or boost are installed in each transmission circuit at the station.

Lightning arresters and fused cutouts are installed on the primary side of the three-phase distribution transformers where overhead transmission circuits are used. The secondaries are similar to those in the 4-kv. radial system.

Primary network with outdoor equipment

The primary network system was laid out using primary distribution units of the outdoor type where open-wire transmision is involved. Each distribution unit consists of a 1,500-kva., three-phase transformer and a five-breaker switchgear unit, together with the necessary auxiliary and control equipment. The transformers are connected directly to the transmission circuits through three-position disconnecting and grounding switches similar to those used with transformers on the low-voltage underground network system. A total of 10 per cent regulation is provided for by means of automatic load tap-changing equipment mounted on each transformer. Switchgear units with breakers having 100,000 kva. interrupting capacity are used up to the point where the interrupting capacity of the breakers will be exceeded. For the heavier load densities switchgear units with 250,000 kva. interrupting capacity breakers are used. In the system having both transmission and network mains underground submersible units with circuit breakers of 250,000 kva. rupturing capacity are installed in underground vaults. All circuit breakers which are not required in the network have been omitted from the primary distribution units.

Sufficient spare capacity is allowed to avoid overloading of any part of the system when any one transmission circuit is out of service. This usually means one spare transmission circuit is necessary for every five or fraction of five required to supply the load.

Network mains with current capacities somewhat greater than 200 amp. connect the various primary distribution units on the 4-kv. side. This distribution transformers, secondaries and most of the 4-kv. laterals are the same as for the 4-kv. radial system.

In the overhead secondary network system, just as in the 13.2-kv. radial system, the distribution transformers are fed directly from the generating station or power substation over 13.2-kv. transmission circuits without any intervening voltage transformation.

No lightning arresters or fused cutouts are employed on the primary side of the three-phase distribution transformers. They are considered unnecessary because the system is designed to carry full load when any transmission circuit is out of service without overloading any part of the system. The distribution transformers are protected against lightning by means of protective gaps installed on their primary side.

The 120/208-volt, three-phase, four-wire overhead secondary network is fed through pole-mounted network protectors connected in the secondary leads of each distribution transformer.

Capitalized losses have small effect

The four types of systems briefly described above and shown in simplified form in Fig. 1 were laid out to serve the 16-square-mile area under static load conditions at four different densities, namely, 750, 1,500, 3,000 and 4,500 kva. per square mile. The entire cost of each system within the area was carefully estimated for each of the four load densities. To the system cost in each case has been added capitalized losses, evaluated in detail for their respective locations in the system, assuming 30 per cent load factor. The only influence which load factor can have in an economic comparison such as this is in the evaluation of losses, providing that each of the systems considered will give satisfactory service. This influence is not of major importance as losses represent a relatively small part of the total cost of any of the systems considered. There is probably an intangible relationship between load factor and diversity factor which cannot readily be included in a study of this kind. The diversity factors used are based upon the best available information.

In general, the main transmission lines between the load area and the generating station have been omitted from the comparison as they are subject to considerable variation in length and add nothing to the completeness of the analysis. Due to the necessity for providing spare capacity some systems require more than the minimum number of transmission circuits, however, and it is only fair that those systems requiring extra transmission circuits outside the load area should be penalized. The transmission distance from the generating station to the boundary of the 4-mile-square area has been assumed to be 8 miles. The cost of the extra transmission over this distance, including losses, plus $50,000 to cover the cost of each extra switching position in the generating station, has been added to the cost of the system within the load area.

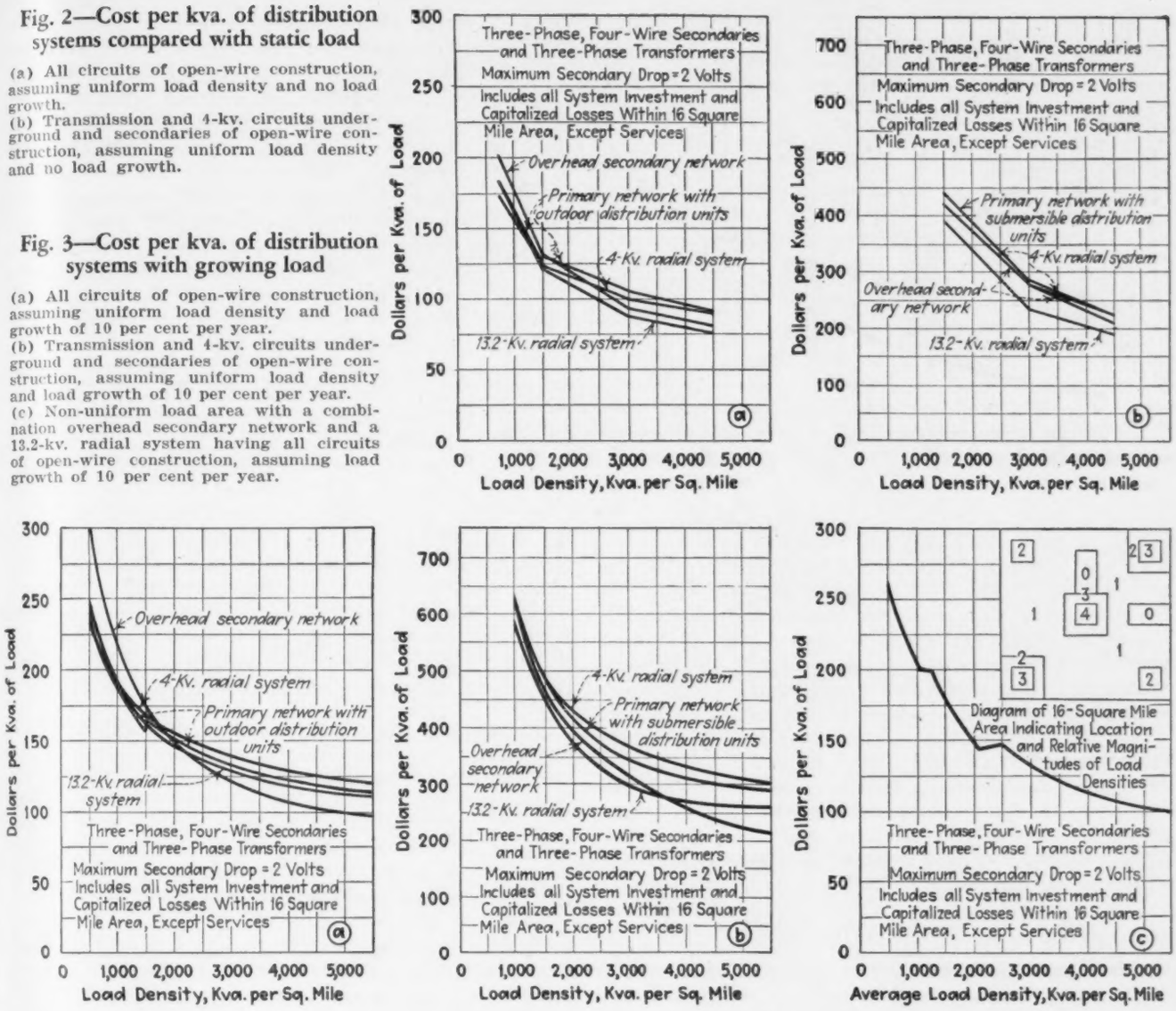
A static load study, since it neglects load growth, is the simplest and most obvious type of system cost analysis. Such a study serves as a valuable check on a more detailed type of study. Also it will often prove to be sufficiently accurate for purposes of comparison. This is particularly true when the systems being compared

Fig. 2—Cost per kva. of distribution systems compared with static load

(a) All circuits of open-wire construction, assuming uniform load density and no load growth.
(b) Transmission and 4-kv. circuits underground and secondaries of open-wire construction, assuming uniform load density and no load growth.

Fig. 3—Cost per kva. of distribution systems with growing load

(a) All circuits of open-wire construction, assuming uniform load density and load growth of 10 per cent per year.
(b) Transmission and 4-kv. circuits underground and secondaries of open-wire construction, assuming uniform load density and load growth of 10 per cent per year.
(c) Non-uniform load area with a combination overhead secondary network and a 13.2-kv. radial system having all circuits of open-wire construction, assuming load growth of 10 per cent per year.


Dollars per Kva. of Load
Load Density, Kva. per Sq. Mile
Average Load Density, Kva. per Sq. Mile
Three-Phase, Four-Wire Secondaries and Three-Phase Transformers
Maximum Secondary Drop = 2 Volts
Includes all System Investment and Capitalized Losses Within 16 Square Mile Area, Except Services
Overhead secondary network
Primary network with outdoor distribution units
Primary network with submersible distribution units
4-Kv. radial system
13.2-Kv. radial system
Diagram of 16-Square Mile Area Indicating Location and Relative Magnitudes of Load Densities
(a)
(b)
(c)

are of the same general type or when the results show a large cost difference.

As a result of the static load studies it was found, when using overhead aerial-cable transmission or underground cable transmission circuits installed in ducts, that the overhead secondary network system was considerably more expensive than the other types of systems considered. However, the overhead secondary network system showed up rather favorably when using open-wire overhead transmission or when all circuits except the secondaries are placed underground in ducts. The way in which the costs of the various systems compare under these latter two conditions is shown in Figs. 2a and 3b, respectively.

The fact that electrical distribution systems are not readily built with capacity exactly equal to load requirements, but instead must be constructed in steps so as to be always ahead of load requirements, makes for an average system cost greater than that found by a system analysis based on static load conditions. It is obvious, when considering the types of systems being covered in this analysis, that they are not equally adapted for taking care of load growth. Suspecting that this factor has considerable influence upon the cost of each of these systems and might be sufficient to alter conclusions which would be drawn from the static load studies, it was decided to extend the basic comparison to include this factor. This was done for the two conditions where, as a result of the no-load growth analysis, the overhead secondary network appeared to have economic possibilities. These conditions, as has already been pointed out, are, first, where open-wire overhead transmission is used, and, second, where all circuits except the secondaries are placed underground in ducts.

Growing load gives network advantage

In the load growth studies each of the systems has been applied to a uniform load in the 16-square-mile area growing from 8,000 kva. to 85,600 kva.—that is, from 500 kva. per square mile to 5,350 kva. per square mile—at the rate of 10 per cent per year. Considerable variation in rate of load growth should not materially change the comparison.

By referring to the system load curve shown in Fig. 4 it will be noted that to facilitate the analysis and approximate actual conditions the load has been assumed to grow

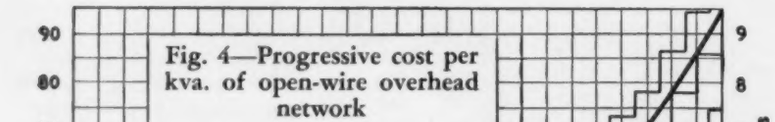


Fig. 4—Progressive cost per kva. of open-wire overhead network

Uniform load growth of 10 per cent per year in 16-square-mile area.

in yearly steps. Each system was carefully laid out to serve the entire load area and expanded as required to keep the system capacity sufficiently in excess of the growing load. The total system investment within the load area was then evaluated for each step. Fig. 4 shows, in addition to the load curve used in all of the load growth studies, the installed system capacity and the total system investment curves for the overhead secondary network system using open-wire overhead transmission. Similar curves were obtained for all of the systems being considered and from them were derived cost data as a function of load density. Detailed cost figures and capitalized losses for a number of densities covered by the curves are shown in the accompanying table. From this table it can be seen just where in the systems the differences in costs occur.

2,300 to 3,800 kva. the critical load densities

Curves showing system investment per kva. of system peak load for the various load densities were plotted. To these were added an approximation of the capitalized losses taken from the data obtained in the static load studies. This sum of system investment plus capitalized losses per kva. has been plotted against load density in the form of smooth curves in order to facilitate comparison between curves. These curves are shown in Figs. 3a and b.

For use in all of the studies mentioned above detailed system cost data have been collected from the best available published sources. From these data and discussions with power company engineers cost figures have been derived which are considered fairly representative of average conditions. It is appreciated that certain of these figures may be changed considerably by local conditions, but since these average figures have been used throughout the analyses it is expected that local conditions will not alter the general conclusions as to relative costs of the systems.

A comparison of the load growth cost curves in Figs. 3a and b with similar curves obtained from the static load studies, Figs. 2a and b, shows that additional system investment in all cases is required to take care of the load growth. Due to the fact that in some cases the system capacity can be kept closer to the system load than in others this additional investment varies with the type of system. This is readily seen by referring to the two sets of cost curves and noting that the relative positions of some of the curves have changed as a result of taking load growth into account. For example, in Fig. 2a the 13.2-kv. radial appears to be the economical system throughout most of the range of densities covered. However, when load growth is considered the overhead secondary network system is the least expensive of all of those considered for load densities above approximately 2,300 kva. per square mile. It is interesting to note that the cost curves indicate load growth can be provided for in a network system at less expense than in a radial.

Summarizing the results of the various studies described above, in so far as they relate to systems employing open-wire transmission, the overhead secondary network is the most economical for load densities from about 2,300 kva. per square mile to the maximum density considered. Where all circuits except the secondaries are placed underground the overhead secondary network is more economical than the other systems beyond about 3,800 kva. per square mile and it is cheaper than either the 4-kv. radial system or the primary network throughout the entire range of densities covered by the studies.

Change to underground affects the balance

The general economic field of application for the overhead secondary network has been definitely indicated. However, when studying a specific area the cost of changing over the existing system must be weighed against the savings to be made by adopting the overhead secondary network. When an obsolete portion of the existing system must be replaced the cost of changeover at that time will be relatively small. Due to the fact that in many areas the system will eventually have to be placed underground this expense should also be considered when selecting an overhead system. In cases where the overhead secondary network appears to be the economical system it can probably also be converted to an underground system with least expense.

Because of the wide range of densities to be found in almost any load area of considerable size it will often prove economical to employ more than one type of distribution system. This is particularly true where the average load density is below about 2,000 kva. per square mile. In cases of this kind it is very desirable that the system used in the lighter density portions of the area be economical and also such that it can readily be converted to the system used in the heavier density sections of the area. It is important that this latter system be economical for these heavier densities, because as the load grows this system will be extended to take more and more of the load growth. Eventually all load growth will be taken on the system originally employed in only the heavier loaded sections, and it may even supersede the system used to supply the lighter loaded portions of the area.

The 16-square-mile non-uniform load area shown in Fig. 3c was selected for study. The figures shown in the area represent relative load densities. At an average load density of 500 kva. per square mile the majority of

the area, designated as 1, has a density of 395 kva. per square mile, and those sections designated as 2, 3 and 4 have densities of 790, 1,185 and 1,580 kva. per square mile respectively. It was proposed to serve the area using overhead transmission circuits. Reference to Fig. 3a indicated that the primary network is the most economic system for the densities existing in the area. However, it was also noted that with the assumed load growth of 10 per cent per year, in a comparatively short time some of the areas could not be most economically fed by means of a primary network. For the higher load densities the overhead secondary network is, according to Fig. 3a, the economical system to use. Since the primary network introduces a voltage and much equipment into the area which has no place in the ultimate plan and does not readily lend itself to changeover to the overhead secondary network it was discarded in favor of the 13.2-kv. radial system. This system, as can be seen by referring to the curves in Fig. 3a, can be installed almost as cheaply as the primary network system, and because of its marked similarity to the overhead secondary network it can readily and with a comparatively small amount of expense be changed to the latter system.

As a result of the above considerations it was decided to use the 13.2-kv. radial system for the lighter density portions and the overhead secondary network for the sections where the density exceeded about 2,300 kva. per square mile. The cost of serving the area with this combination system is shown in Fig. 3c. At an average load density of 500 kva. per square mile all of the system is radial. By the time the average density reaches about 1,300 kva. per square mile the areas 2, 3 and 4 have all been changed to the network system, and the entire area has been changed over when an average density of about 2,500 kva. per square mile is reached. It is of interest to note that the cost of serving the non-uniform load area, Fig. 3c, is less than the cost of serving a similar size uniform load area with the overhead secondary network system if the density is light, or with the 13.2-kv. radial system throughout if the density is heavy. Work which has been done to date indicates that the cost of serving an area such as that in Fig. 3c with a single type of system will be more than the cost shown in Fig. 3a for serving a similar uniform load density area.

Probably one of the largest fields of application of the overhead secondary network system will be similar to that described in connection with Fig. 3c; that is, the system will be used in conjunction with some other form of distribution system to feed the heavier density sections of an overhead area either in the form of spot networks or of comparatively small distributed or street networks. The overhead secondary network is particularly adapted to serve economically small sections where the load density is above 2,300 kva. per square mile or continuity of service is important.

In addition to the economic possibilities which the system possesses, the overhead secondary network is simple and capable of rendering the highest type of service. It has the advantage of transforming directly from transmission to utilization voltage, thereby eliminating the distribution substations and placing the network immediately adjacent to the consumer.

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What Modernized Lighting Did for One Church

By increasing the connected load from 4 to 9 kw. and substituting modern lantern type fixtures, arch reflectors and floods for out-of-date units and inaccessible light sources, the Boston Edison company greatly improved the quality of lighting in St. Anne's Church, Somerville, Mass., as these "before" and "after" views reveal.

Salient Features of Installation

Former intensity, nave, 1 ft.-candle; present, 4.
Chancel lighting by two 14-ft. arch reflectors, each having fourteen 100-watt lamps; murals above altar lighted by four 200-watt floods.
Nave lighting by six 200-watt, two 900-watt and six 300-watt major units.
New units installed at accessible heights for cleaning and maintenance.

Tuning Fork and Stylus Show Circuit Breaker Speed

By ROBERT E. ROWLEY, Jr.

Electrical Engineer Department of Water and Power, City of Los Angeles

One of the most perplexing problems to confront the operating engineer during past years has been the erratic performance of high-tension oil circuit breakers. Investigations of switch performance have been hindered by the lack of a device or system by means of which the velocity of the moving parts could be measured accurately by field or construction crews.

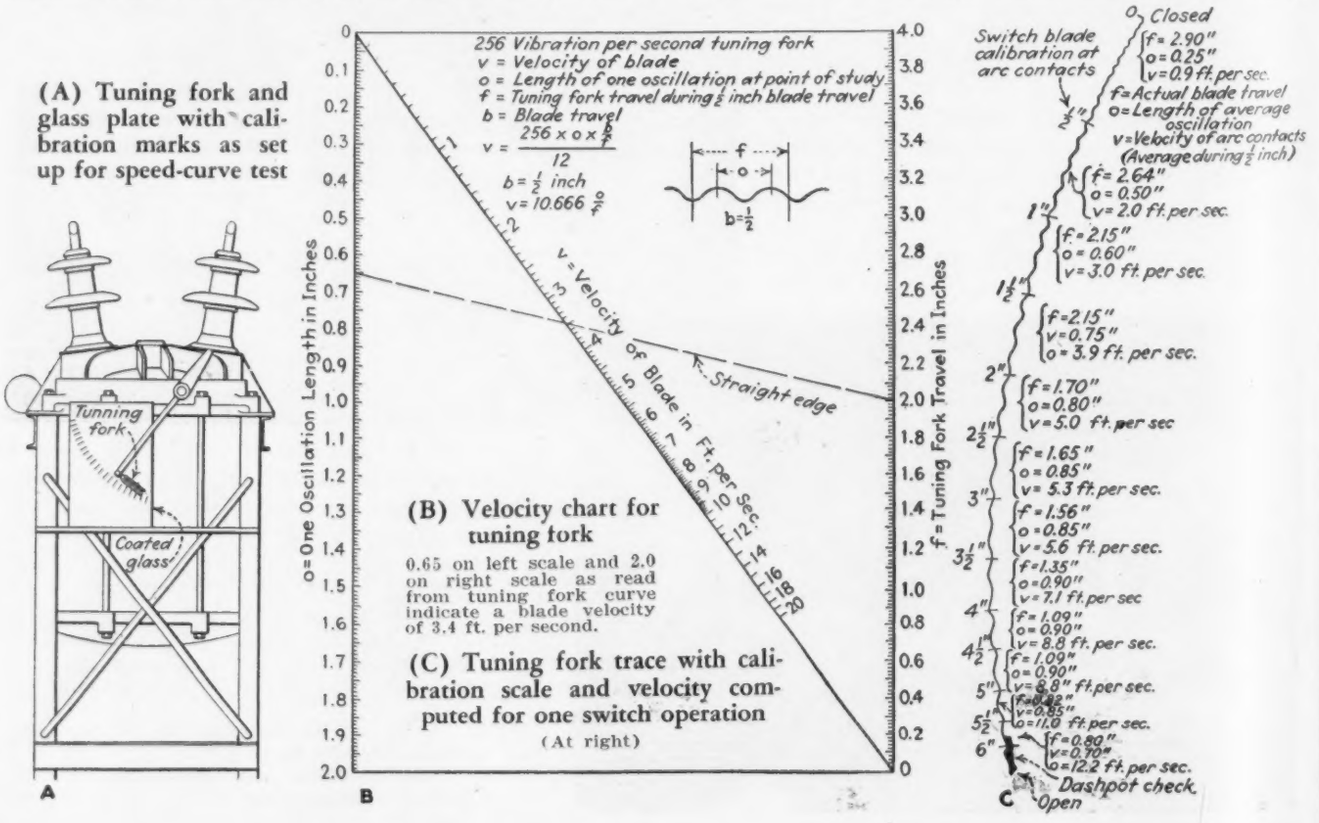
A tuning fork method of studying switch operation was suggested by the writer six years ago which has since been made the basis of regular switch performance tests. Many betterments to switches have been made due to a study of these tests, and as a result a switch failure or faulty operation on the city of Los Angeles system is extremely rare. Many serious failures in switch performance were found to be the result of improper adjustments, changes during operation and faulty construction.

The operating engineer should be able to determine and correct any of the above conditions through a study of records made available with the tuning fork method of studying switch performance. This method of time-space studies makes use of the constant time element of a vibrating tuning fork. A trace is made in which the length is proportional to the movement of the part to be studied while the vibration of the fork has given a time measure from which the velocity of the moving part may be readily computed for any position of its travel. Inconsistency in switch operation and performance characteristics are readily seen from the time-space curve of the trace.

The tuning fork, which is the basis of the method, has a frequency of 256 vibrations per second and is supplied with a stylus fixed to one prong. The fork is fastened by means of a rigid arm to some part of the rotating shaft which passes through the switch tanks as shown in illustration A. One tank must be lowered or opened in order that a calibration curve may be made giving the relative movement between the stylus and the arcing tips or whatever part it is desired to study. The switch is opened by hand and at every half inch of blade travel a calibration mark is made at the stylus point. After the calibration curve measurements (usually made with a pencil on paper) have been obtained a pane of glass, whose surface has been thinly coated with whiting, is placed in a fixture which holds it agaist the stylus point parallel to the path of the fork. The whiting or blacking, if desired, may be applied with a spray gun or brush. Just before tripping the switch the tuning fork is set in vibration by striking. The switch is tripped and the vibrating stylus inscribes a trace through the coat of whiting.

The trace on the glass may be blue printed immediately by exposing a piece of blue print negative under the clean side of the glass and allowing light to come through the trace. A number of records may be made on the same glass by shifting the pane to one side after each trace has been run. This has been found handy for comparison when adjustments have been made between runs.

The velocity at any point of the blade or arc contact travel may be found by first measuring the length of the increment on the trace corresponding to ½ in. of contact travel. Then the distance across one vibration falling



(A) Tuning fork and glass plate with calibration marks as set up for speed-curve test

(B) Velocity chart for tuning fork

0.65 on left scale and 2.0 on right scale as read from tuning fork curve indicate a blade velocity of 3.4 ft. per second.

(C) Tuning fork trace with calibration scale and velocity computed for one switch operation

(At right)

within the above increment is measured. The two measurements are then applied to the accompanying chart (B), which will give the required velocity direct.

A trace as first recorded on the glass in the field is approximately 20 in. long. The blueprint of the trace is readily obtained under even poor light conditions. The rough field inspection quickly will reveal such important information as switch operating time, velocity of contacts at point of separation, maximum velocity of contact opening, dashpot adjustment or other operating characteristics which might be required. Adjustments to a given standard may be made immediately and the switch placed in operation only after meeting all performance requirements.

An office analysis of any trace, as shown in C, will give consecutive points from which velocity-space or time-space curves may be constructed. A study of these curves gives a very clear insight into the causes of many queer switch performances. Having a quick-trip oscillograph available on the system where switch speed curves have been taken, a combined study of the two records after short-circuit interruptions has proved most interesting and beneficial.

Accuracy of the relative movement between the tuning fork stylus and the part to be measured is governed by the rigidity of the connecting train of linkage. The accuracy of the results is controlled in major part by the measurements taken by the observer. The tuning fork has an error in the order of 0.01 per cent. The error of 0.01 in. in one measurement taken from the trace will give a possible error of 1 per cent in the calculation. The results obtained in past studies indicate consistent results, with a maximum deviation of 5 per cent after all sources of error are included.

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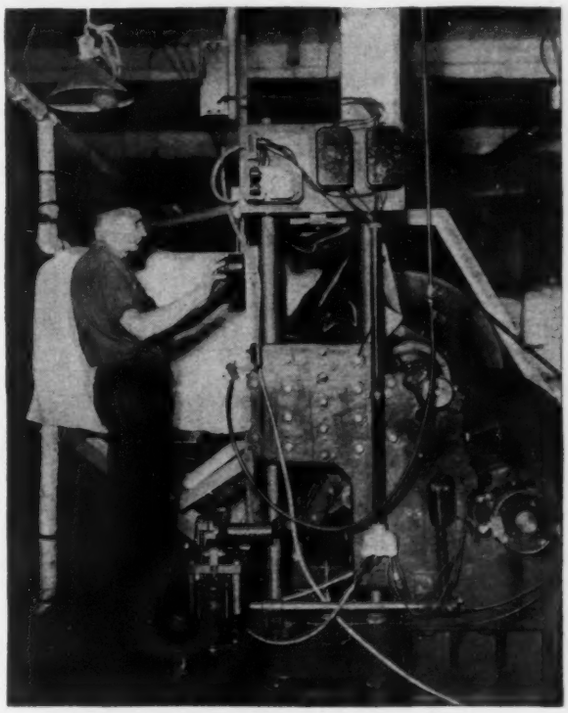
Providing Automatic Operation of Embossing Press

By E. B. LOVEWELL
General Electric Company, Providence, R. I.

Thrustors are used to actuate an embossing press clutch at the Standard Machinery Company, Mystic, Conn., in such a manner that the press will remain on impression a definite time interval.

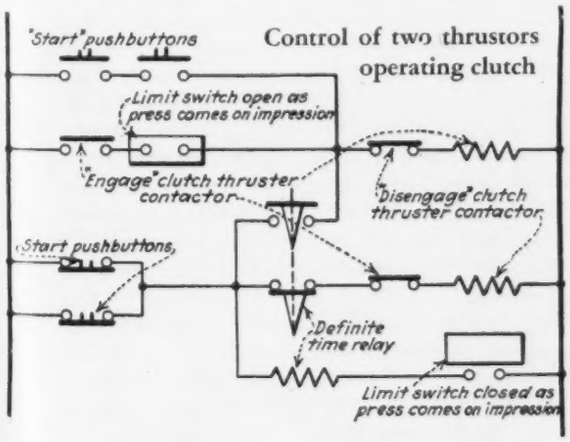
The upper platen of the press is stationary and the lower platen has a rise and fall of 4 in. The motor, belted to a flywheel, turns the driving shaft continuously, a clutch being engaged to cause the lower platen to rise and fall. With the lower platen down in the initial position the material is placed in the mold.

After the pressman loads the mold he engages the clutch by the action of the "engage" thrustor controlled from two push-button stations. The platen rises and automatically a limit switch operates to energize the "disengage" thrustor, which holds the clutch out, while the press stays on impression. The definite-time relay causes the "engage" thrustor. after ten seconds' delay, to lower the platen to the initial position, where the clutch is disengaged automatically. The pressman unloads the mold, puts in new material and the cycle is repeated. The "disengage" thrustor holds the clutch positively out when the platen is at rest. There are approximately four of these cycles each minute.



Thrustors applied to embossing press

Note push buttons on columns and two-limit switches operated by projections on a circular plate attached to a shaft of the press, which makes one revolution for each cycle of operation.

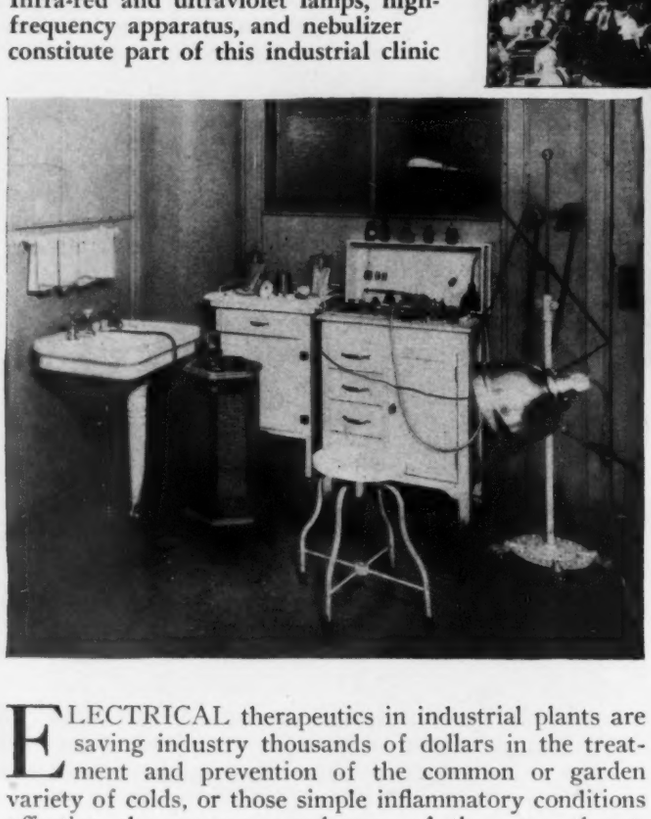

"Start" pushbuttons
Control of two thrustors operating clutch
Limit switch open as press comes on impression
"Engage" clutch thruster contactor
"Disengage" clutch thruster contactor
Start pushbuttons
Definite time relay
Limit switch closed as press comes on impression

Several advantages result. In the first place, the safeguard from injury to the pressman is an important consideration. Both hands are occupied, one on each push-button station, eliminating the danger of getting them caught as the platen comes on impression. Although only momentary contact is necessary, both buttons must be depressed to start the cycle of operation. In addition, the time relay allows the operator to turn out a more uniform product because the period of dwell-on impression remains fixed and uniform indefinitely. Although the time required to lower the platen from an impression to the open position is less than one second, the control consistently brings it to rest at the initial position.

Electrical Therapeutics in Industry

By SANFORD DeHART
Director of Hospital and Employment Departments, R. K. Le Blond Machine Tool Company, Cincinnati

Infra-red and ultraviolet lamps, high-frequency apparatus, and nebulizer constitute part of this industrial clinic



Minor illnesses reduced by installing mercury-vapor lamps with "uviol" tubes

ELECTRICAL therapeutics in industrial plants are saving industry thousands of dollars in the treatment and prevention of the common or garden variety of colds, or those simple inflammatory conditions affecting the mucous membranes of the nose, throat, mouth and respiratory passages.

In an economic study of colds made in Boston, Mass., it was estimated that colds cost more than $20 per person in that city. Another survey made by competent authorities showed that simple colds in the head cause a direct money loss to wage earners in this country of $70,000,000 a year.

A more recent survey made by the United States Public Health Service found that colds caused a time loss equivalent to 1.4 days per year for every man on the payroll and 2.1 days for every female employee. Colds were responsible for 39 per cent of all absences among men and 31 per cent among women.

Can any thing be done to minimize this colossal cost to the employer and employee?

I can answer unequivocally, "Yes."

Fourteen years ago we equipped a nose and throat room in our shop for the purpose of conducting researches into the cause and prevention of colds. I am using the term "colds" to cover a multitude of conditions, such as acute coryza, rhinitis, pharyngitis, bronchitis, la grippe, influenza and incipient tonsilitis.

Parenthetically, I wish to say that during the past fourteen years we have experimented with practically every device for which there has been extravagant claims made for the cure or prevention of colds. These have included the chlorine gas treatment and the immunization by inoculation and various other methods which were found to be inadequate and were discarded after a fair trial.

We have kept careful statistics for the past several years and we find that absenteeism due to colds among our employees is being materially and gratifyingly reduced each year.

In the treatment of these conditions, the method of procedure is about as follows: When the foreman finds a worker suffering from a cold he immediately sends him to our nose and throat room, where the patient's temperature is taken and his chest, throat and nasal passages are examined. If there is no elevation of temperature and no alarming symptoms revealed by the examination the medical attendant sprays the patient's nose and throat. This procedure is repeated three times during the day, and for several days if necessary. Our employees, both shop and office, are very enthusiastic about this treatment. One of our vice-presidents recently remarked to the writer that our nose and throat room was one of the best investments the company ever made.

The original investment of our nose and throat room, including equipment, was approximately $800, but it has paid for itself many times. The equipment consists of

an infra-red lamp, nebulizer, high-frequency apparatus and a quartz lamp for the administration of ultraviolet rays.

Any one who has ever tried to work while suffering from a stiff neck knows the excruciating pain one has to suffer when so afflicted. The recognized concentration of electric heat rays, by properly constructed heat lamps, is an inexpensive and highly satisfactory method of treating this condition. Relief is generally obtained in about twenty minutes.

For the past two years we have been experimenting in the shop with a new Cooper-Hewitt light tube which has a "uvoil" glass tube transmitting 2,650 angstroms, or the same registration as June sunlight. Tests made in our shop over a period of several months show that the ultraviolet light emanated from these lamps has caused an appreciable decrease in the number of absences due to minor illnesses, in addition to furnishing excellent illumination. Because the industrial worker is confined at his work during the entire period when he might otherwise receive the sun's rays, we consider this an ideal combination, in which the vital health quality is added to industrial lighting.

We now have more than 400 of the old type Cooper-Hewitt lamps in service in our plant, and as fast as these tubes burn out we are replacing them with the new "uviol" glass type.

The efficiency of the ultraviolet treatment in the prevention of colds is illustrated by the work carried on at Cornell University, where, under the direction of Dr. Dean F. Smiley and Dr. George H. Maughan, controlled experiments have been conducted for more than three years. In this test the entire male student body was segregated into various groups, dependent upon their susceptibility to colds; 25 per cent of each group took the treatment, and the measured result indicated a reduction in colds of 42½ per cent in those treated as compared with similar susceptible groups not treated.

This preventive cold test conducted at Cornell University during the year 1929-31 includes the following:

1. A fifteen-lamp solarium using 50-in. Cooper-Hewitt mercury lamps in Corex-D tubes. In this maze none of the light of the fifteen lamps is wasted, and a person getting his sixteen minutes of irradiation, passing through the sixteen definite steps, received sufficient ultraviolet light to produce a condition very near erythema.

2. Five National Carbon Company arc lamps with supertan carbons arranged in a circle approximately 9 ft. in diameter. A person has to stand in front of each of these lamps two minutes in order to get a dose approximately just inside erythema.

With these facilities they can take 60 men an hour in the Cooper-Hewitt maze and 30 men an hour in the National Carbon maze. In the National Carbon maze each student gets ten minutes irradiation; in the Cooper-Hewitt each student gets fifteen minutes irradiation.

It is estimated that this amount of irradiation of the whole skin surface once a week is equivalent to what the average person gets in the summer time if his neck, hands and wrists are exposed as usual. Feeling that twice a week might be better, Dr. Smiley says: "We are expecting to try two irradiations per week this next term."

A large mine in the Middle West also has equipped a sun room which is to be used for exposing its employees to the ultraviolet rays for the prevention of colds and respiratory troubles.

In a recent survey made to ascertain the newer methods for the treatment of colds I found that one large concern of national importance was operating an elaborate nose and throat clinic in connection with its shop hospital, in which emergency treatment is administered to the employees suffering from acute colds and sore throats. Daily clinics for the nose and throat are held by a specialist in attendance. In these cases local treatment is given when this is of simple character, and in other cases of a prolonged nature the patient is given daily ultraviolet treatments in a large solarium provided by the company. The excellent results which this company has obtained from the procedure it has adopted to prevent and treat colds has been a factor in its recent insistence that all its subsidiaries be similarly equipped.

The nose and throat clinics of the Garment Trades Workers, New York, are operated on a co-operative basis. In other words, the clinics do not give gratuitous service, but charge a nominal rate of $1 a year.

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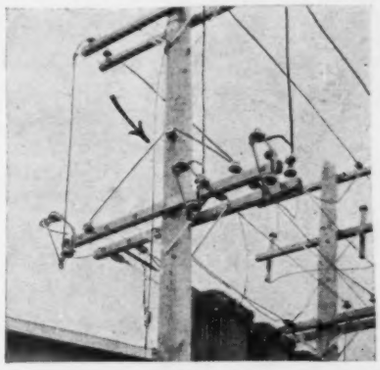
Radio Complaint Exposed Hazard

Since people have become critical of quality of radio reception, complaints of interference have occasionally exposed dangerous line conditions before personal injury or property damage resulted from them. In the accompanying illustration is shown a condition that was discovered in a radio interference investigation by a large utility in the Middle West.

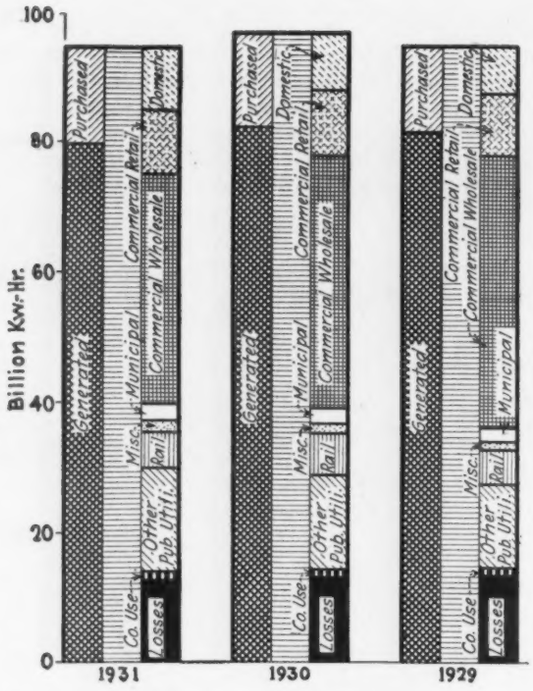
This investigation disclosed that a guy wire at a power transformer installation had been installed too close to a driveway so that trucks in passing had broken the guy off close to the ground. It had fallen back against the pole to which it was attached, reaching to within a foot of the ground, and came in contact with a conductor energized at 11,000 volts. The arrow marks the point of contact of the guy wire with the energized conductor. The guy wire was removed, eliminating a hazardous condition which might have been serious. This experience could have been avoided if a guy stub had been set on the opposite side of the driveway and the structure supported by a span guy over the drive to the stub.



Broken guy-wire in contact with 11-kv. line revealed by radio complaint

Utility operators who grumble about the cost of checking up radio complaints should estimate what damages a jury would have awarded in a case of death or personal injury that might have resulted from such a condition. Probably the damages would have been enough to pay the cost of radio interference investigations for several years.

Energy Data Given by 172 Large Systems



What becomes of the energy of major systems

142 light and power systems in the United States had more than 100,000,000 kw.-hr. output during 1931 — together generated 79,491,000,000 kw.-hr. — 92 per cent of country's total.

Billion group embraces 27 here and five in Canada.

New York Edison system leads in energy generated.

Industrial use falls, domestic rises.

ELECTRIC light and power systems in the 100,000,000-hw.-hr. group in the United States numbered 142, generated 79,491,000,000 kw-hr. in 1931 and purchased another 15,338,000,000 kw-hr. (largely from one another), making in all 94,829,000,000 kw.-hr. to be distributed. They produced this energy in 1,919 power plants having a combined rating of 29,912,275 kw., 28.4 per cent of it water power. In generated output they account for 92 per cent of the whole electric light and power industry in the United States, in generator rating for 91 per cent.

In addition there are fifteen such systems in Canada, not counting a number of large industrial establishments contributing only a negligible amount of energy for public utility purposes. These Canadian systems, with 3,669,224 kw. in 128 plants, generated 14,317,000,000 kw.-hr., and, with what they purchased, disposed in all of 16,936,000,000 kw.-hr. The amount generated, it may be remarked, was equivalent to one-sixth of the industry's entire production in the United States during the same year.

The annual supplement accompanying this issue of the ELECTRICAL WORLD presents detailed data on the operations of these various systems, also on one in Mexico. Figures are given also for fourteen electrically operated railways and railroads. In all cases tabulated the output, generated plus purchased, exceeded 100,000,000 kw.-hr. with the exception of two in the last group, which were retained in the list because the diminution of their output under the specified minimum is assumed to be temporary.

In the billion-kilowatt-hour group in the United States there are 27 systems with a combined output, generated and purchased, of 56,706,000,000 kw.-hr. Their generated output alone was 49,600,000 kw.-hr., 62.5 per cent of the total here tabulated and 57.3 per cent of the total of all electric light and power plants in the United States.

The New York Edison system leads in generated output, with 5,138,200,000 kw.-hr., but in total it is exceeded by the Niagara-Hudson with 5,911,409,390 kw.-hr., 16 per cent of it purchased. Next, in close succession, come the Pacific Gas & Electric Company, the Ontario Hydro system and the Commonwealth Edison, all between 4,200,000,000 kw.-hr. and 4,560,000,000 kw.-hr. Of the Canadian group five are in the billion-kilowatt-hour class, with a combined output exceeding 13,314,000,000 kw.-hr.

In Table I* they are listed in order of total output, generated plus purchased; Table II* gives their plant capacity, allocation of output among the various classes of customers and the number of customers in each class.

To summarize the statistics on plant and energy output for individual companies, the insert at the bottom of Table II* has been prepared. Various comparisons, relating chiefly to electric light and power companies in the United States, are presented in text tables III to 1X inclusive. The aggregate energy generated decreased 3.3 per cent from 1930, but it constituted a slightly larger fraction of the national total, 92 per cent against 91 per cent. This total is based on reports of the U. S. Geological Survey.

The amount purchased increased materially, from 14,945,000,000 kw.-hr. to 15,338,000,000 kw.-hr., but is again approximately balanced by sales to other public utilities. It thus represents in the main the aggregate of inter-company transfers. The data do not reveal the reason for the increase, but much of it can probably be

**See accompanying supplement.*

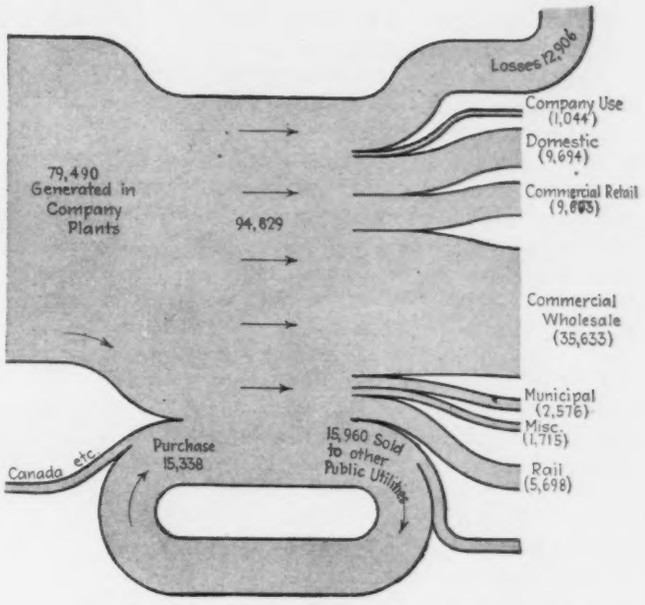
ascribed to the widespread drought, which necessitated transfers of energy on a large scale.

It is in the allocation of energy that the effect of recent economic conditions is strikingly revealed (Table III). Large light and power sales decreased for the second consecutive year, this time by nearly 9 per cent, clearly as a result of reduction in factory operations. A minor decrease is revealed also in small commercial sales, but domestic energy use increased by 9 per cent. Energy for railway operation decreased. Under this head company-owned railway departments are included, as well as other railways and electrically operated railroads. One company also reported energy for bus and coach operation.

The rise in "other sales" resulted from a variety of causes. Some companies reported sales to rural customers under this head; others included these under "domestic." Some reported energy for domestic and commercial heating, others included this also under "domestic." Energy for irrigation was evidently given under "other sales" by some.

In a few instances the allocation differed from that here adopted and the best feasible adjustments had to be made to fit the tabulation scheme. Some did not completely allocate their sales and in compiling the summary estimates had to be made in order to account completely for the 94,829,000,000 kw.-hr. generated and purchased.

In some returns domestic and commercial retail sales were combined, likewise customers. In some rural were combined with domestic, in others they were reported under "other ultimate consumers." Also, the line between small commercial light and power (retail) and large commercial (wholesale) is not the same for all companies. Sales for the former average around 3,400 kw.-hr. annually per customer for the entire group, but some company averages vary widely from this. Thus in New England most companies have a smaller average, down to 1,590 kw.-hr. per customer, but the top figure is 6,200. Reclassifications bring shifts in the relative



Combined energy stream of 142 light and power systems

(Quantities are in million kilowatt-hours)

numbers of retail and wholesale customers and in their energy consumption from year to year (Table VI).

These peculiarities are all shown in detail in the supplement and should be taken into consideration when studying the operations of individual companies, to avoid erroneous conclusions.

In comparison with the national totals, the effect of such adjustments as had to be made was small; the relationships exhibited by the summary tables may therefore be accepted as essentially correct.

The increase in residential sales and the decrease in commercial sales from 1930 to 1931 changed the proportions of the several classes to the total sales (Table III). The former rose from 13.1 to 14.9 per cent; commercial retail from 14.5 to 14.9 per cent; commercial wholesale fell from 57.3 to 54.9 per cent.

Energy for company use was in some reports combined with losses, making the total for that item slightly larger than it should be. The two items combined constitute 14.6 per cent of generated plus purchased energy and 17.5 per cent of generated alone.

Average energy consumption per residential customer again shows an increase, this time from 551 kw.-hr. in 1930 to 605 kw.-hr. (Table V). The highest regional averages are found in the two western groups of states. As might be expected, the sales per customer of these 142 systems are somewhat greater than those for all systems, large and small, in the United States, estimated at 580 kw.-hr. At the same time the figures given somewhat understate the facts for they include none of the energy reported as "other sales," though

Table III—Allocation of Output of Major Light and Power Systems in 1931, 1930 and 1929*

Class of Service	142 Systems in 1931			142 Systems in 1930			137 Systems in 1929		
	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales
Domestic	9,694	10.2	14.9	8,860	9.1	13.1	7,561	8.0	11.3
Commercial retail	9,603	10.1	14.8	9,836	10.1	14.5	9,184	9.7	13.7
Commercial wholesale	35,633	37.6	54.9	38,934	40.2	57.3	41,752	44.1	62.5
Municipal	2,576	2.7	4.0	2,501	2.6	3.7	2,230	2.4	3.3
Other sales	1,715	1.8	2.6	1,572	1.6	2.3	971	1.0	1.5
Railway operation	5,698	6.0	8.8	6,209	6.4	9.1	5,149	5.4	7.7
Used by ultimate consumers	64,919	68.4	100.0	67,912	70.0	100.0	66,847	70.6	100.0
Other public utilities	15,960	16.9	.....	14,945	15.4	.....	13,290	14.0	.....
Used by companies	1,044	1.1	.....	1,019	1.0	.....	1,395	1.5	.....
Losses, etc.	12,906	13.6	.....	13,225	13.6	.....	13,199	13.9	.....
Total	94,829	100.0	.....	97,101	100.0	.....	94,731	100.0	.....
Company use plus losses in per cent of generated	.....	17.5	.....	.....	17.3	.....	.....	17.9	.....

* In each year the allocation in a few of the returns was incomplete and estimates had to be used.

some of the latter was doubtless used for residential heating and cooking, separately metered.

The 142 systems serve 78.0 per cent of all electric light and power customers in the country directly (Table VI) and a large additional number indirectly through smaller companies and municipal systems that purchase part of the 15,960,000,000 kw.-hr. sold to other public utilities. The percentage would also be increased by adding the customers under "other sales to ultimate consumers," some of them rural, others apparently taking energy for domestic heating and cooking, presumably counted also under "domestic."

To avoid an excess of notes on the supplement tables certain simplifications were necessary. Free energy and franchise requirements, also energy used by other departments, when indicated with energy for company use, was included as reported. Energy for company railway departments was included under electric railway operations. "Locations served" count as customers. "Industrial" was generally counted as large light and power; "commercial," when the average per customer was small, as small light and power; light for county, state and federal buildings with municipal lighting.

Group statistics are given in a few instances for properties which, though distinct corporate entities, are so interconnected and operated as to constitute in each case a single physical system. This is in accord with previous practice. The operating company remains the unit on which the tabulation is based.

In Table I of the supplement the figures for earlier years are taken from previous issues of the supplement for the same companies or for the predecessors of present companies when the sequence was evident; because of corporate changes they do not necessarily represent operations in identical areas, and the statistics are therefore not always directly comparable.

One innovation has been introduced, in that separate figures are given for the system peak and the peak on generating stations. Among other things this should bring out the effect of interconnections as equivalent to reserve capacity. It is to be expected that the present reduction of industrial load far below the 1929 level, the necessary addition of a certain amount of new plant since 1929 despite that reduction and the recognized obligation of the light and power industry to meet industrial demands when manufacturing activity builds up, however rapidly, should all contribute to make an unusually wide margin between present capacity and the demand at the time of peak load.

Plant factors decrease

How the reduced output in 1930, and again in 1931, affected the plant factors is brought out in Table VII. In each geographical region the average hourly station load—that is, generated kilowatt-hours divided by 8,760—is compared with the aggregate station rating.

With a few exceptions the utilization of plant rose to a maximum in 1929. Then the loads dropped off, while new capacity was added for reasons that were entirely logical at the time. The result was a decrease in plant factor for the entire group of reporting companies from 35.9 per cent to 32.7 and then to 30.3 per cent. In Canada, with its more favorable conditions created by 24-hour loads in the huge paper-and-pulp, lumber and electrochemical plants, the factor climbed to 61.7 in 1929;

Table IV—Comparison with Entire Industry

	1931	1930	1929
Major systems			
(a) Number	142	142	137
Energy, million kw.-hr.			
(b) Generated	79,491	82,194	81,561
(c) Purchased	15,338	14,907	13,170
(d) Sum, (b) + (c)	94,829	97,101	94,731
Total industry in U. S.			
Energy, million kw.-hr.			
(e) *Generated*	*86,595*	*89,952*	*91,421*
Ratio (b) / (e), per cent	92	91	89
Aggregate kw.			
(f) Major systems	29,912,275	28,907,755	25,911,781
(g) *U. S. total*	*32,922,311*	*31,976,138*	*29,558,637*
Ratio (f) / (g), per cent	91	90	88

Table V—Average Energy per Residential Customer, Major Systems

Geographical Region	Kilowatt-Hours 1931	1930	1929
United States	**605**	**551**	**492**
New England	510	467	415
Middle Atlantic	538	483	441
East North Central	610	580	526
West North Central	590	545	501
South Atlantic	661	589	520
East South Central	592	530	440
West South Central	508	470	415
Mountain	702	692	556
Pacific	861	793	635

Table VI—Number of Customers of Reporting Companies

	1931	1930	1929
Domestic	16,021,506	16,053,261	15,363,715
Commercial retail	2,837,248	2,702,519	2,713,658
Commercial wholesale	399,551	318,595	460,628
Sum	19,258,305	19,074,375	18,538,001
Per cent of U. S. total	78.0	77.6	76.7

Table VII—Regional Plant Factors

Generated Kw.-Hr. ÷ (Plant Kw. × 8,760) Expressed in per Cent

Region	1927	1928	1929	1930	1931
New England	27.2	29.2	30.1	26.3	26.0
Middle Atlantic	33.7	35.0	37.3	34.7	32.3
East North Central	35.7	35.3	35.1	31.5	29.6
West North Central	31.1	32.8	34.1	32.7	28.6
South Atlantic	28.5	28.1	30.9	27.0	24.6
East South Central	31.2	27.1	27.6	26.1*	26.3
West South Central	38.5	35.2	41.9	38.6	33.2
Mountain	44.6	49.6	48.6	45.5	34.1
Pacific	40.6	39.2	41.1	37.8	35.5
United States	**34.1**	**34.3**	**35.9**	**32.7**	**30.3**
Canada	**57.2**	**55.2**	**61.7**	**51.1**	**44.4**

*Excluding 239,700 kw. available by lease or contract, not included in 1929 or 1931.

Table VIII—Comparison of Generated and Purchased Energy by Geographical Regions

In per Cent of Total (= Generated + Purchased) Output

Region	1927 Gen.	1927 Purch.	1928 Gen.	1928 Purch.	1929 Gen.	1929 Purch.	1930 Gen.	1930 Purch.	1931 Gen.	1931 Purch.
New England	84.6	15.4	81.3	18.7	83.7	16.3	81.4	18.6	78.4	21.6
Middle Atlantic	87.0	13.0	86.3	13.7	89.1	10.9	89.5	10.5	89.0	11.0
E. North Central	89.2	10.8	86.6	13.4	82.9	17.1	79.3	20.7	77.4	22.6
W. North Central	98.0	2.0	98.1	1.9	98.6	1.4	98.0	2.0	98.0	2.0
South Atlantic	87.8	12.2	86.6	13.4	83.8	16.2	83.3	16.7	79.6	20.4
E. South Central	76.4	23.6	79.7	20.3	73.2	26.8	72.8	27.2	70.5	29.5
W. South Central	86.1	13.9	85.7	14.3	83.7	16.3	84.0	16.0	83.6	16.4
Mountain	93.4	6.6	89.0	11.0	89.7	10.3	88.1	11.9	88.3	11.7
Pacific	86.2	13.8	86.3	13.7	87.3	12.7	84.6	15.4	87.8	12.2
United States	**87.5**	**12.5**	**86.5**	**13.5**	**86.1**	**13.9**	**84.7**	**15.3**	**83.8**	**16.2**
Canada	**82.7**	**17.3**	**86.6**	**13.4**	**88.9**	**11.1**	**87.4**	**12.6**	**84.6**	**15.4**

Table IX—Five-Year Analysis of Company Use and Losses by Geographical Regions

Energy Consumed for Companies' Own Use, and Energy Lost or Unaccounted for, in per Cent of Energy Generated in the Plants of Reporting Companies

Region	Intracompany Use					Lost and Unaccounted For					Combined Company Use and Losses				
	1927	1928	1929	1930	1931	1927	1928	1929	1930	1931	1927	1928	1929	1930	1931
New England	1.50	2.71	1.56	1.28	2.05	16.60	16.90	15.20	15.35	15.82	18.10	19.61	16.76	16.63	17.87
Middle Atlantic	2.31	2.24	1.44	1.26	0.96	13.45	13.90	13.70	13.85	14.00	15.76	16.14	15.14	14.11	14.96
East North Central	2.57	2.62	2.11	1.48	1.41	12.94	12.65	13.70	13.03	13.99	15.51	15.27	15.81	14.51	15.40
West North Central	1.64	1.29	1.27	0.81	0.62	15.34	14.60	13.70	13.20	13.49	16.98	15.89	14.97	14.01	14.11
South Atlantic	2.39	2.12	2.23	2.06	2.16	12.70	13.00	17.02	17.90	19.10	15.09	15.12	19.25	19.96	21.26
East South Central	8.18	3.73	4.28	1.15	1.01	18.00	18.70	18.40	19.30	18.30	26.18	22.43	22.68	20.45	19.31
West South Central	3.58	5.14	3.23	2.08	1.78	17.30	15.28	13.75	15.40	16.43	20.88	20.42	16.98	17.48	18.21
Mountain	2.60	1.86	1.99	2.80	2.38	11.03	8.73	15.67	16.00	17.30	13.63	10.59	17.60	18.80	19.68
Pacific	1.62	1.53	2.10	1.24	1.59	20.72	24.05	23.12	23.10	22.46	22.32	25.58	25.22	24.34	24.05
United States	**2.59**	**2.38**	**1.97**	**1.44**	**1.32**	**14.85**	**15.20**	**15.53**	**15.78**	**16.24**	**17.44**	**17.58**	**17.50**	**17.22**	**17.56**

the decrease was far more severe than in the United States, to 44.4 per cent in 1931.

Intercompany purchases vary widely. This item reflects the degree to which dependence is placed on interconnections. It rises to a high value in the Southeast and is smallest in the West North Central States. The increase from 1929 to 1930 and to 1931 may in large measure be ascribed to the widespread drought prevailing in the two latter years, whereby companies relying upon water power were obliged to call on their steam-operated neighbors for help in carrying their loads. Regional and national averages are given in Table VIII.

Energy for intracompany use, plus losses in transmission and distribution, have scarcely changed at all for the country as a whole in the five-year period under consideration (Table IX). About 17.5 per cent of the energy generated fails for one reason or another to reach the ultimate consumer. The losses are in general smaller in the more densely populated parts of the country.

In reviewing this item differences in reporting must be considered. Some companies have plainly included energy for the operation of other company-owned utilities, such as railways or ice making; others seem to have reported here the energy used for station auxiliaries instead of eliminating it from output. In still other instances it was grouped with losses. Compared with the entire amount generated by all the companies these disparities are small. They do, however, show in some of the regional percentages.

The tabulation was made possible only through the full co-operation of the companies represented. The data are published exactly as received, with the exception of the few adjustments previously mentioned.

For detailed data and summaries for earlier years reference should be made to the issues of ELECTRICAL WORLD for May 2, 1931; May 3, 1930; May 18, 1929; May 5, 1928, and April 20, 1927, with corresponding supplements.

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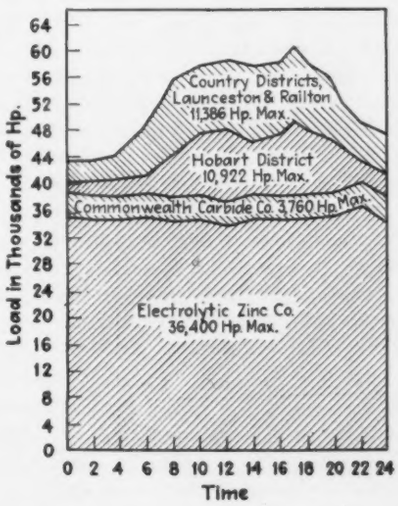
79% Load Factor in Tasmania



Here is the sort of load curve a utility can get if it has a large enough electrochemical load. The chart represents the output of the Hydro - Electric Commission of Tasmania on a typical winter day. The electrolytic zinc load, as appears elsewhere in the report from which the chart is reproduced, had the extraordinary annual load factor of 93.6 per cent in the year ended June 30, 1931. The annual system load factor was 79 per cent. That year, in Tasmania as elsewhere, was one of reduced consumption. Five years ago the zinc company load factor was 96.5 per cent.

Tasmania is about as large as New Hampshire, Vermont and Massachusetts combined; its population is less than that of Delaware. The Hydro-Electric Commission, a government agency, furnishes almost the entire electric service in the state. Comparison of the rates with those of privately owned companies in the United States reveals marked similarity, except that the spread between wholesale power and retail domestic service rate is somewhat wider.

The chief consumer, the Electrolytic Zinc Company, paid £83,073 for 224,500,000 kw.-hr., which was 69 per cent of the whole energy output of the system. That works out as 0.18 cent per kilowatt-hour.

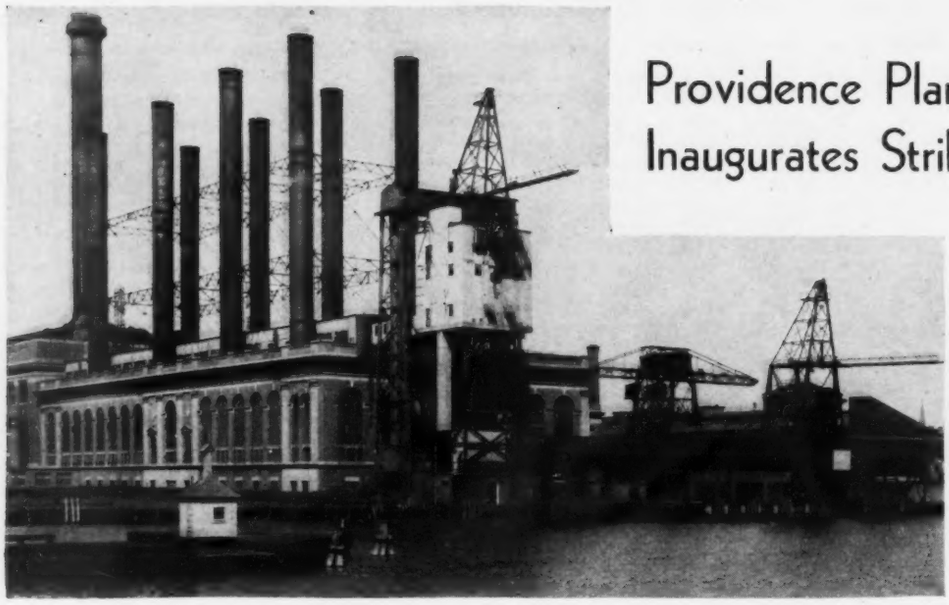
The lowest domestic and commercial lighting rates are those in Hobart and Launceston—10 cents for the first 1,000 kw.-hr. per quarter; all in excess, 6 cents, the English penny at 2 cents. For heating and cooking the rate is 2 cents per kilowatt-hour; for continuous hot water, 1 cent.

The rate for motive power is 4 cents for the first 120 kw.-hr. per quarter per horsepower; all in excess, 1 cent.

Rates outside of the two cities named are higher; in a few municipalities they run up to 20 cents and in one to 22 cents; in most of the others 15 or 16 cents is the rule. This applies to the first block, which generally ranges from 80 to 200 kw.-hr. per quarter.

Even with these rates the revenue exceeded the operating expenses and interest by only 1.6 per cent during the past fiscal year, so that this state-operated utility can scarcely be accused of charging exorbitant rates for the purpose of earning excessive profits. Presumably the enterprise pays no taxes.

Virtually the entire service is from a single hydroelectric plant, with long transmission lines and no local reserve plants.



Providence Plant Transfer Inaugurates Striking Economies

At least $275 per day for the first five years of its term is the average anticipated saving of a twenty-year contract effective January 1, 1932, between the Narragansett Electric Company and the United Electric Railways Company, Providence, R. I., under which the former assumes responsibility for traction power supply in that territory. Both companies are subsidiaries of the New England Power Association. The Rhode Island Public Utilities Commission has approved the contract and the economic and operating advantages of the arrangement are noteworthy.

Decreasing demand for trolley service in the Providence district since 1925, combined with improvements in power-generating facilities and interconnected transmission on the New England Power system, brought about a situation for the railway company which might be described as progressively unsatisfactory. Miles of trolley track operated fell from 320.5 to 182, cars operated from 480 to 330 and car-miles from 14,531,998 to 9,950,000 in 1931. At the railway's 48,000-kw. generating station, Manchester Street, Providence, the net kilowatt-hours produced fell from 67,100,000 in 1926 to 36,000,000 in the first three quarters of 1931 and the average cost per kilowatt-hour, including operating expenses, maintenance, taxes, depreciation and 6 per cent fixed charges on $2,150,000 (the selling price of the plant), rose from 1.29 cents to 1.69 cents. A study of the cost trends showed that had power been sold to the railway at a 1.5-cent base rate by the Narragansett company in 1929 on the net output of 63,100,000 kw.-hr. at Manchester Street the railway would have lost $64,000 on its total energy production, but would have gained $16,000 on the total power used in its own service. In 1930 the scale of economy would have tipped to the central-station side of the transaction, the total savings for the railway plant reaching $27,000 on 52,900,000 net output and $83,000 savings on its own usage. The cost per kilowatt-hour for railway use only increased sufficiently to make the purchase of central-station energy considerably more advantageous than was the case when power sold by the railway to other transportation systems was included.

The best solution of the economic problem was found to be through the sale of the railway plant to a realty subsidiary of the New England Power Association, its lease to the Rhode Island Power Transmission Company (the wholesaling transmission subsidiary of the association in that state), its operation by the Rhode Island in connection with the Narragansett system and the purchase of all traction energy required from the Narragansett company by the United Electric Railways. The transfer of the Manchester Street station at the selling price previously named took place at the close of 1931. The price of energy to the railway company is 1.5 cents per kilowatt-hour with a coal clause adjustment above $6 and below $4 per ton. A standard power factor of 95 per cent is specified for three-phase, 25-cycle, 11-kv. energy delivered to the railway. No energy can be resold by the railway except under existing contracts, which will expire within a few years.

The advantages to the railway are: (1) Disposal at a fair price of a power plant which is rapidly becoming obsolete without any adverse effect on current earnings, as any book loss on the sale is to be absorbed by a valuation reserve set up on the railway books; (2) a fixed cost per kilowatt-hour regardless of any decline in the use of power by the railway; (3) expected savings in power cost from $50,000 to $160,000 per year; (4) relief from the necessity of further investment for future power plant expansion or replacements by the railway; (5) substantial savings in office overhead, i.e., fewer problems for the railway management; (6) ability to substitute bus lines for trolleys without considering the adverse effect this would otherwise have on power costs. The advantages to the Narragansett company include a handling charge of 0.25 mill per kilowatt-hour; the addition of railway load to the Narragansett system through a 20,000-kw. frequency-changer installation at Manchester Street, when operating conditions warrant such a course, with possible improvement in South Street load factor and more effective use of interchange facilities with the New England Power system, and the use of available capacity at Manchester Street station by the Narragansett company at certain peak periods through the frequency-changer equipment now installed.

A contract has lately been made between the Narragansett company and the Rhode Island Power Transmission Company for 15,000 additional kilowatts, with provision for further increases. The Narragansett station, according to President R. F. Whitney, has a safe generating capacity of 95,000 kw. and a maximum demand exceeding 100,000 kw. The latest addition to this

plant was in 1926. A site has been purchased at Bristol, R. I., on tidewater, for a future steam plant, but President Whitney said at the hearing before the Rhode Island commission that from $6,000,000 to $10,000,000 present outlay would be postponed by increasing takings from the New England Power Association system, with its available primary capacity at the Fifteen-Mile Falls development on the upper Connecticut River. A rate of $29 per kilowatt-year of primary capacity is named in the new contract.

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Wattmeters Give Power Factor on Unbalanced Load

By G. W. STUBBINGS
London, England

A 120-deg. shift of all the voltage connections for conventional three-wire, three-phase power metering offers a reliable method of ascertaining the power factor on unbalanced loads. A common procedure is to multiply the difference of the two conventionally connected wattmeter readings on test loads by $\sqrt{3}$ and thus obtain the reactive volt-amperes of the load. This is only true if the circuit is accurately balanced, and the error in the determination of the power factor by this method may be of the same order as the fractional difference between any two of the line currents.* A difference, for instance, of 5 per cent in the values of the currents may cause an error of 5 per cent in the calculated value of the power factor. If the results of this method of power-factor determination are to be reasonably accurate great care must be taken in balancing the test load. Accurate balancing is very difficult when testing heavy current meters, using low-voltage transformers to supply the meter current transformers.

A much more accurate method of obtaining the power factor of a three-phase test load, one which takes cognizance of the unbalance, is to obtain the sum of the wattmeter readings in the usual way for power measurement and then to change the connections of the voltage circuits of the wattmeters cyclically so that a phase shift of 120 deg. is made. This can be done very conveniently by means of a three-pin plug and socket. If W_1 is the true value of the total watts in the circuit and W_2 the sum of the wattmeter readings when the phase of the wattmeter voltages is made to lag by 120 deg., then, if the total vector volt-amperes in the circuit be called M, the power W_1 is equal to $M \cos \phi$ and W_2 is equal to $M \cos (\phi - 120 \text{ deg.})$. From these two expressions it is easy to obtain:

$$\tan \phi = \frac{1}{\sqrt{3}}\left(1 + \frac{2W_2}{W_1}\right)$$

or

$$\tan \phi = \frac{1}{\sqrt{3}}(1 + 2n),$$

where n is the ratio W_2/W_1

This formula gives the tangent of the phase angle of the circuit, and when testing meters on specified power factors it is in many ways more convenient to work with tangents rather than cosines of the circuit phase angle. The formula for $\cos \phi$ is, however easily found to be:

$$\cos \phi = \frac{\sqrt{3}}{2} \cdot \frac{1}{\sqrt{(n^2 + n + 1)}}$$

Care must be taken in using this method that attention is paid to the sign of W_2. For lagging power factors this may be either positive or negative. Moreover, one or both of the wattmeters may be reversed by the phase shift of the instrument voltages. As long as the reading of a reversed wattmeter is reckoned negative corrects results will be obtained.

It will be seen that the quantity M is introduced only to correlate W_1 and W_2 and that it cancels in the final result. It also appears that as the power factor, $\cos \phi$, obtained in the manner described, is calculated from the active and reactive power, this value satisfies the official A.I.E.E. definition of three-phase power factor; i.e., the cosine of the angle whose tangent is the ratio of reactive power to active power. The results of the method are quite accurate provided the voltages are symmetrical, however unbalanced the currents may be.

Incidentally, a very convenient method of checking the balance of the currents of a three-phase test load is to change over the line 1 and line 3 connections to the terminals of the two wattmeters (Fig. 1) after measuring the power in the circuit. The effect of the changeover is to associate the current system with an artificial negative sequence voltage system, and the sum of the wattmeter readings will then depend only upon the negative sequence component of the current system. If the currents are balanced this component will be zero and the sum of the wattmeter readings, with the amended connection of the voltage circuits, will also be zero, however the phase of the applied voltages may be varied, provided these voltages are balanced. In this process no polarities should be reversed, because that amounts to one of the methods of ascertaining the reactive component, namely, the cross-phasing method.

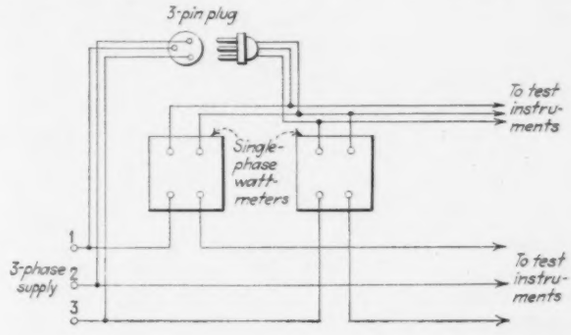


Fig. 1—Cyclic shift of voltage connections gives power factor

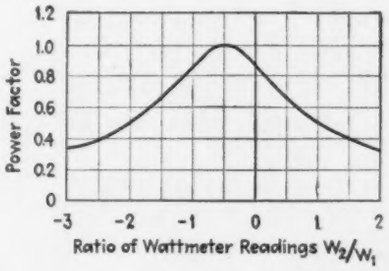
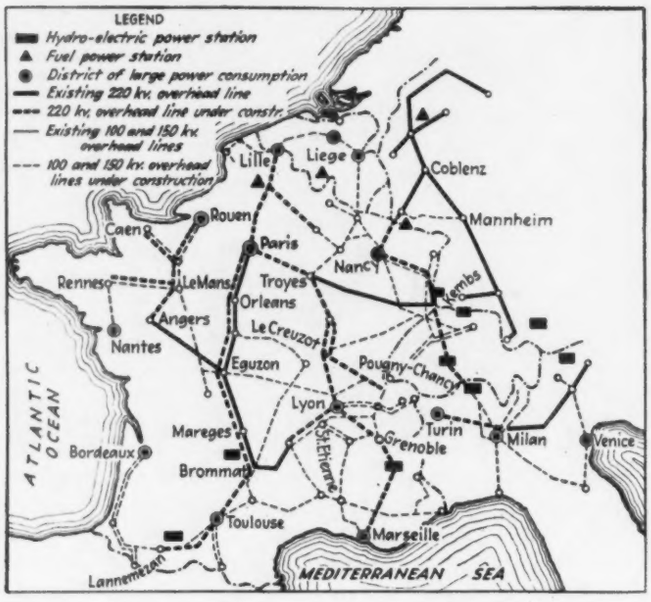


Fig. 2 — Prevailing power factors from ratio of wattmeter readings

Method calls for 120 deg. shift of all voltage connections to wattmeter voltage terminals

*See "Electrical World," December 29, 1923, pages 309-314.

New 220-Kv. System for France



To improve the facilities for supplying power to Paris, Lyons, Marseilles, etc., as well as to large mining districts and to electric railways, the French power supply companies have decided to interlink the various networks through a number of extra high-voltage lines. A voltage of 220 kv. has been adopted for the mains and 150 kv. for the branch lines, according to Nikolay von Kotschubey of Zurich.

The main lines will transmit power generated in the Pyrenees and in hydro-electric power stations situated at Brommat to Paris, Marseilles and Lyons. A 220-kv. line is now under construction interlinking the water-power stations at Brommat, through Marèges, Eguzon and Orleans with Paris. A branch 220-kv. line will start at Eguzon and be prolonged in the northwesterly direction to Angers. Later on it is expected that short 220-kv. lines will connect Angers with Le Mans, Rennes, Caen and Rouen. The main 220-kv. lines will interlink Brommat with Lannemezan, the latter being already a part of the Chemins de Fer du Midi network. (It is possible that this section, owing to the short distance, will operate at 150 kv). Another line will connect Lyons to Troyes; the latter already has a 220-kv. connection east to the hydro-electric station at Kembs (200,000 hp.) on the Rhine. Several branch lines will go from Lyons in the direction of Brommat and through Grenoble (touching the networks of the water-power plants of the Alps) to Marseilles.

The existing line of Chancy-Pugny will be rebuilt for operation at 220 kv. and supply power to large works situated at Le Creusot.

It has not yet been decided whether the branch lines will operate at 150 kv. or 100 kv., but it is assumed that in the future only one standard pressure will be adopted.

The 220-kv. line which is under construction will transmit a constant output of 100,000 kw. from Brommat to Paris. When completed (double line) it will increase this output up to 200,000 kw. An additional 100,000 kw. will be directed to St. Etienne.

Electric Service to Oil Refineries

By W. S. BAUGH

Kansas Gas & Electric Company, Wichita, Kan.

Convincing an oil refinery operator that he can save money by purchasing electricity is not a problem whose solution can be reduced to a general formula by virtue of which the power salesman has only to point out the dotted line for the contract to be signed. This conclusion is inescapable from the report presented by the writer as chairman of the refinery committee to the recent convention of the Petroleum Electric Power Club. The report is essentially a presentation of data received in response to questionnaires addressed to members of the committee.

The data were supplied by six electric utilities on 34 oil refineries, of which nineteen are in Oklahoma, eleven in Kansas, three in Texas and one in Missouri. The object of the committee's study was to learn, first, how much electric power was being sold to refineries and, second, how much could be sold if they were completely electrified. The difficulty of the job is apparent from the diversity of the data in the tables. The listing

Table I—Pumping of Cooling and Boiler Make-Up Water Represents Large Load

Since it is improbable that the quantities of water given are secured from meter readings, they are subject to a check as to accuracy.

Plant No.	Average Bbls. Crude Run per Day	Average Bbls. Circulating Water per Day	Bbls. Water per Bbl. Crude
1	800	10,300	12.90
2	1,500	13,700	9.15
3	3,000	20,600	6.87
4	864	1,417	1.64
5	2,500	72,000	28.80
6	2,400	34,300	14.30
7	2,460	9,540	3.87
8	2,340	9,250	3.95
9	3,000	20,600	6.87
10	3,400	41,200	12.10
11	3,290	111,100	33.80
12	3,000	82,300	27.4
13	.....	.....	.....
14	3,000	68,600	22.82
15	2,000	27,400	13.70
16	3,000	25,700	8.57
17	4,800	12,930	2.69
18	.....	.....	.....
19	7,500	171,500	22.90
20	4,660	420,500	90.30
21	9,000	154,200	17.15
22	15,350	698,000	45.50
23	18,000	.....	.....
24	10,000	274,000	27.40
25	13,750	815,000	59.30
26	11,000	.....	.....
27	8,770	727,000	82.90
28	10,000	171,500	17.15
29	20,000	685,000	34.25
30	6,000	.....	.....
31	3,400	6,860	2.02
32	5,190	10,000	1.93
33	9,340	.....	.....
34	14,000	257,000	18.35

in Table II is in accordance with the eight classifications in the refinery census published in the *Oil and Gas Journal* of March 5, 1931.

It is apparent that oil refineries represent a class of power customers whose operating and other conditions require continuous study of their economics and that, therefore, in addition to general or average data a thorough familiarity with each case as it confronts the power salesman is essential. This is necessary not only on account of the present complexity of refinery methods but also because of possible—and probable—future developments in the art. Consequently the data presented here should be considered only as informatory and indicative and should not be used as the sole basis for determining how much load can be expected from any particular refinery.

Table II—Electrical and Mechanical Power in Oil Refineries

Column No. 6 can only represent an educated guess as to the power capacities involved and if the data in this column are not accurate, then the same degree of inaccuracy will carry through columns 7, 8 and 9. The same thing applies to column 13, which in turn controls the degree of accuracy of column 14. The figures given in columns 15 and 16 are accurate as far as they go.

Again the accuracy of column 19 depends upon the accuracy of the data given in column 13. With these exceptions the data given in this table should be reliable.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
			Power Capacity Required to Operate Refinery—Kw.							Energy in Kw.-Hr. Required to Operate Refinery					Cost of Elec. Energy Purchased				Kw.-Hr. per Bbl. Crude	
Plant Number	Cap. in Bbls. Crude per 24 Hours	Actual Crude Run in 1931, Thousand Bbls.	Elec. from Util.	Elec. from Private Plant	Total Elec. Kw. (3+4)	Mech. Power	Total Elec. and Mech. (5+6)	Total Kw. Required per Thousand Bbls. Crude (7÷1)	Per Cent Electrified (5÷7) 100	Elec. Energy from Util. in Thousands of Kw.-Hr.	Elec. Energy from Private Plant in Thous. of Kw.-Hr.	Total Elec. Energy (10+11)	Energy from Mech. Pr. in Thousands of Kw.-Hr.	Total Elec. and Mech. Energy (12+13)	Dollars	Cents per Kw.-Hr.	Per Cent Yearly Load Factor for Purch. Energy	Pur. Energy (10÷2)	Total Elec. and Mech. Energy (14÷2)	Plant Number
I—Skimming																				
1	1,500	292	0	0	0	23	23	15	0	0	0	0	....	.....	.....	....	0	0	....	1
2	2,500	547	52	0	52	6	58	23	90	460	0	.....	....	.....	.....	....	100	0.84	....	2
3	4,000	1,095	30	0	30	200	230	58	13	.....	0	.....	....	.....	.....	....	....	....	....	3
II—Skimming and Cracking																				
4	1,000	315	52	0	52	48	100	100	52	188	0	188	126	314	3,561	1.895	41.3	0.597	0.998	4
5	2,500	913	100	0	100	202	302	121	33	.....	0	.....	532	.....	.....	....	....	....	....	5
6	2,700	876	0	0	0	187	187	69	0	0	0	0	985	935	.....	....	0	0	1.12	6
7	3,500	900	55	0	55	212	267	76	21	252	0	252	468	720	4,071	1.67	52.3	0.28	0.80	7
8	4,000	856	100	0	100	130	230	58	44	414	0	414	600	1,014	6,125	1.48	47.3	0.484	1.18	8
9	4,000	1,095	225	0	225	112	337	84	67	.....	0	.....	....	.....	.....	....	....	....	....	9
10	5,000	1,241	70	0	70	45	115	23	61	615	0	615	118	733	.....	....	100	0.496	0.59	10
11	5,000	1,200	208	0	208	160	368	74	57	868	0	868	480	1,348	12,248	1.41	47.7	0.723	1.12	11
12	5,000	1,095	5	0	5	262	267	53	2	44	0	44	....	.....	.....	....	100	0.04	....	12
13	5,000	....	250	0	250	350	600	120	42	1,440	0	1,440	2,760	4,200	.....	....	65.8	....	....	13
14	5,000	1,095	327	0	327	227	554	111	59	.....	0	.....	....	.....	.....	....	....	....	....	14
15	5,000	730	100	0	100	128	228	46	44	.....	0	.....	....	.....	.....	....	....	....	....	15
16	6,000	1,095	80	0	80	170	250	42	32	.....	0	.....	....	.....	.....	....	....	....	....	16
17	8,000	1,750	142	0	142	150	292	37	48	816	0	816	395	1,211	10,091	1.24	65.6	0.467	0.693	17
18	10,000	....	1,470	0	1,470	0	....	...	..	.....	0	.....	....	.....	.....	1.165	....	....	....	18
19	13,000	2,740	300	0	300	450	750	58	40	.....	0	.....	....	.....	.....	....	....	....	....	19
20	15,000	1,700	620	0	620	524	1,144	76	54	3,518	0	3,518	2,401	5,919	34,016	0.969	64.8	2.07	3.48	20
21	18,000	3,285	396	140	536	450	986	55	54	7	.....	.....	....	.....	.....	....	....	....	....	21
22	20,000	5,607	1,152	75	1,227	1,000	2,227	111	55	7,404	1	7,405	3,065	10,470	72,949	0.985	73.5	1.32	1.87	22
23	25,000	6,570	3,300	0	3,300	0	3,300	132	00	21,014	0	21,014	0	21,014	163,806	0.779	72.8	3.2	3.2	23
III—Skimming, Cracking, and Lubricating Oil																				
24	11,000	3,650	1,250	0	1,250	300	1,550	141	81	10,800	0	10,800	....	.....	.....	....	98.8	2.96	....	24
25	18,000	5,020	1,260	125	1,385	1,121	2,506	139	55	8,376	5	8,381	6,465	14,846	83,377	0.994	76.0	1.67	2.96	25
IV—Skimming, Cracking, Lubricating Oil, Asphalt and Wax																				
26	20,000	4,015	....	....	....	....	....	...	0	0	.....	.....	....	.....	.....	....	0	0	....	26
V—Skimming, Cracking and Asphalt																				
27	10,000	3,200	820	0	820	1,692	2,512	251	33	4,672	0	4,672	6,815	11,487	46,886	1.001	65.1	1.46	3.59	27
VI—Skimming, Cracking, Lubricating Oil and Wax																				
28	10,000	3,650	1,050	0	1,050	575	1,625	162	65	.....	0	.....	....	.....	.....	....	....	....	....	28
29	30,000	7,300	1,600	2,200	3,800	450	4,250	141	89	14,000	19,400	33,400	....	.....	.....	....	100	1.92	....	29
VII—Skimming and Lubricating Oil																				
30	6,500	2,190	250*	590	840	....	....	...	..	218*	4,336	4,554	....	.....	.....	....	100	0.0995	....	30
VIII—Complete Refineries																				
31	5,000	1,242	1,027	0	1,027	750	1,777	356	58	6,089	0	6,089	1,971	8,060	.....	1.08	67.7	4.9	6.5	31
32	8,000	1,892	700	500	1,200	425	1,625	203	74	2,812	1,983	4,795	1,118	5,913	.....	1.10	45.8	1.49	3.12	32
33	12,000	3,429	900	1,200	2,100	1,308	3,408	284	62	3,968	12,546	16,514	3,420	19,934	51,394	1.29	50.4	1.16	5.82	33
34	16,000	5,110	550	1,240	1,790	600	2,390	150	75	.....	.....	.....	....	.....	.....	....	....	....	....	34

*Bought from municipality.

How Toledo Edison Cut Accidents 90 per Cent

By A. HOEFLE
Engineer Toledo Edison Company

REAL progress in accident prevention work is never an accident. It is the result of deliberate and persistently applied effort by every one connected with the program.

The accident prevention performance of the Toledo Edison Company in 1930 and 1931, compared with previous years, is an illustration of this point. This company overhauled its accident prevention program early in 1930 with rather startling results. The following table shows the performance for the last four years:

	1928	1929	1930	1931
Average number of employees	1,400	1,317	1,389	1,191
Number of fatal accidents	1	5	1	1
Total number of lost-time accidents	84	77	30	8
Number of days lost time*	10,820	31,072	6,411	6,241
Accidents per million hours worked	.....	22.09	7.73	2.62
Accidents per hundred employees	6.0	5.85	2.16	0.67
Days lost per thousand hours worked	.....	8.9	1.65	2.046
Days lost per hundred employees	130	81.4	29.6	20.2
Standing in N.E.L.A.,-East Central Division	13	11	1	†2

*A fatal accident is rated at 6,000 days, total disability at 3,000 days.
†The company in first place is a small company, having 64 employees.

The standing of the company in the East Central Division of the N.E.L.A. is based on a no-accident contest. The improvement in standing was made in the face of severe competition and remarkable improvement of the whole group.

Not least of the many factors which brought about this showing by the Toledo Edison Company was the strong support given by the management. It was realized that the responsibility for accident prevention could not be divorced from the authority for securing it. There was therefore created a central committee, composed of the safety director, department heads and general foremen, which meets once a month in the office of the superintendent of operations. Here accident preventive measures are discussed and every accident of the previous month is thoroughly analyzed. Before this assembled committee the department head or general foreman in whose department an accident occurred must give an accounting of each case. The desire of these men to avoid the necessity of discussing an accident in their respective departments, but rather to report genuine progress, is a real incentive to "carry on" down the line. These men, in turn, place responsibility for accident prevention where experience has indicated that it belongs, with the gang foremen.

The company safety director exercises general supervision of accident prevention activities. The various meetings that are held are co-ordinated and arranged so as to be most effective. All literature and posters are cleared through his office. Contact with city, state and national safety organizations are also maintained by him.

The individual employees are reached most effectively through the gang foremen. Bulletin boards presenting pertinent posters are generously used. Literature of various kinds is distributed to the department heads and foremen. It is felt that their personal influence and instruction, rather than flooding each man directly with literature, is more effective in teaching the subject matter.

Safety record board in linemen's assembly room

Asbestos suit gives workman a chance in case of fire or explosion

Every employee attends at least one hourly meeting each month in which accident prevention measures are discussed. Some groups of men, whose work may be considered a little more hazardous, have meetings at more frequent intervals, at which their peculiar problems receive special attention. At all meetings accident prevention is stressed, while first aid procedure is given minor attention. It is felt to be of greater importance to prevent an accident than to secure perfection in the measures to take after an accident has happened. The only exception to this rule is the teaching of an artificial respiration method. Every employee must learn this method and is regularly given opportunities to review it by class drills.

Interest in the regular meetings is maintained by interchanging speakers between departments and groups. Line department groups, for instance, are lectured on the elements of metering and interior wiring. Boiler room operators may hear talks on substation operation. An undercurrent of safety and accident prevention propaganda is maintained in these contacts. The result is that the meetings hold the interest of the men and they profit accordingly.

Discipline has been an important factor and must not be overlooked. The measures available are:

(a) Admonition.
(b) Reprimand.
(c) Transfer to less desirable jobs.
(d) Suspension.
(e) Domotion.
(f) Dismissal.

Where the situation calls for it, a foreman may be disciplined for the actions of his men. In all cases where an accident has occurred in which some safety rule or precaution was violated it is made clear that the disciplinary steps are for violation of the rule and not for the accident. It goes without elaboration that the enforcement of discipline must be fair, impartial and certain.

Exceptional results along accident prevention work are rewarded in various ways. Automobile drivers who have "no-accident" years receive appropriate buttons. At the present time there have been many five-year buttons issued, indicating five years' regular driving without an accident. Publicity in the company news publication stimulates interest. Occasionally certain foremen and men who have performed hazardous tasks especially well are sent to out-of-town gatherings or on inspection trips to other companies in the interests of accident prevention.

Things done and not done

Some very excellent results are obtained through the use of the safety record boards. Each department displays one of these boards in a prominent location so that every man in that department will see it often. On the board is listed every man's name under that of his foreman. An accident causes a colored button to be placed opposite the name of the man having the accident. If there is no lost time the button is green; if there is lost time the button is red. There are also two colored lights at the top of the board. One is green and is lit the first of each month. If a lost-time accident occurs in the department, the green light is extinguished and a red one is lighted. The effect of these boards in creating interest has been surprising. The men work hard individually and collectively to keep "off the board."

Space does not permit detailed explanations of the numerous safety appliances and practices adopted. Goggles, improved ladders, improved rubber protective devices and their testing routine, adoption of round manhole covers, adoption of various interlocking devices, teaching of knot tying, insistence on orderliness on trucks and in shops and many more related improvements have been made.

The improvement in the accident prevention record is not the result of wholesale rebuilding of lines or stations. Working conditions have not been appreciably changed. The distribution system, both aerial and underground, contains many old lines and lines of recent acquisition, some of which were not built with modern safety principles in mind. Lines are worked "hot" at voltages to and including 6,900, and at higher voltages by the use of standard live-line tools.

In conclusion, there is a feeling that what looked like a difficult task was accomplished with comparatively little effort. No fads, drives or courses were necessary to bring out the desire of the men to co-operate. That desire is present in every one and only needs an intelligent opportunity to assert itself.

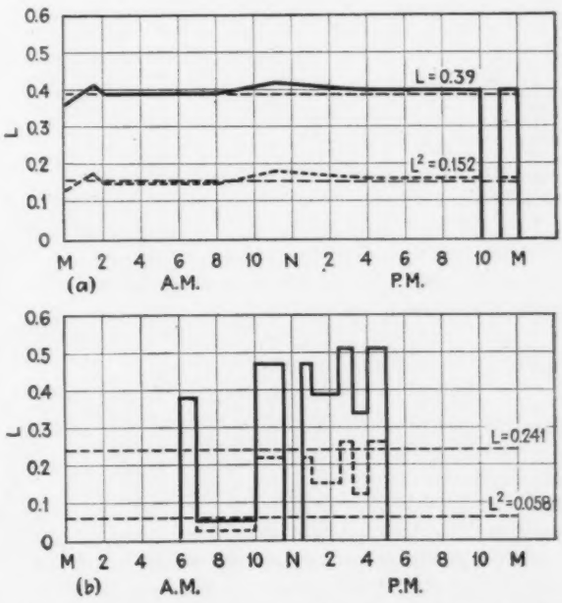
Closed Delta May Be More Economical Than Open

By L. M. GROW
Electrical Engineer
Central Ohio Light & Power Company, Wooster, Ohio

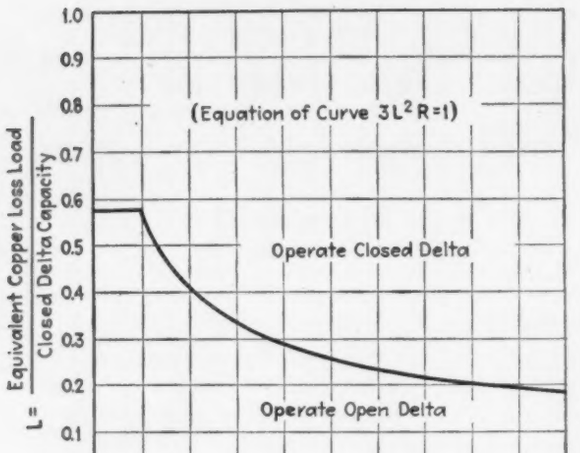
If the third transformer is available—money already spent on its installation—it may be economical in some cases to operate a bank-closed delta even though the third unit is not necessary for capacity purposes. The economy comes from the reduction of losses under certain conditions of operation.

A method for ascertaining the relative operating costs of open and closed delta connections was inspired by a particular case on the system of the Central Ohio Light & Power Company. An oil pumping station was served by three transformers in closed delta. The load was somewhat reduced by certain changes in the pump impellers and thus brought well within the capacity of two of the three transformers. The third transformer could not be used elsewhere on the system and to take it out meant simply that it would be returned to stock. Offhand, one would assume that the capacity of the bank should be reduced to fit the load, but analysis of load conditions proved that the operating cost—that is, total of copper and core losses—was actually less with the over-capacity closed delta than with the reduced-capacity open delta connection.

First determine the average ratio of the full load copper losses to the core losses of each transformer and call this ratio R. Next determine loss factor, L, by means of the constant 24-hour load, which will give the same copper losses as the actual load using the customary procedure of squaring the load ordinates and



Load losses expressed as equivalent 24-hour loads
(a) Constant oil pipe line pumping.
(b) Typical industrial motor load.



Closed or open delta operation is determined by load factor and transformer core loss ratios

obtaining the average height of the squared curve, which is proportional to the copper losses. The square root of this value is the constant 24-hour load, which will give the same copper losses as the actual load. It is fraction L of the closed delta capacity. Two typical calculations with their values of L are shown in the accompanying graphs.

Then with the values of R and L, refer to the third graph. If the point corresponding to the two values falls in the upper area closed delta connections will be the most economical, while if the point falls in the lower area open delta connections will be most economical.

Should the actual values of the total 24-hour losses in watts be desired they may be obtained from the equations:

Total Loss Closed Delta =
$3 \times$ Core Loss $+ 3L^2 \times$ Full Load Copper Loss (1)

Total Loss Open Delta =
$2 \times$ Core Loss $+ 6L^2 \times$ Full Load Copper Loss (2)

where both core and full load copper losses are for one transformer and all transformers are assumed to be similar.

In some applications, where the nature of the load is such that it does not substantially repeat itself every 24 hours, it may be necessary to use a weekly basis, the only difference in the procedure being the use of the weekly load curve instead of the daily load curve in the determination of L.

From a study of the graphs and their equations the following conclusions may be reached.

1. Transformers having a ratio R of one or less (i.e., core loss not exceeding full load copper loss) should always be operated open delta since, when R is one, the value of L for equal losses is 0.577. This corresponds to a constant 24-hour load equal to the full open delta capacity of the bank or the maximum possible load cycle.

2. Ordinary transformers with their ratios of R between one and four will require, for equal losses, a value of L of approximately five to three respectively. This means that the bank must operate at a good load factor before closed delta connections will be justified; in fact, it can be shown that the minimum load factor with the peak load equal to the open delta capacity must exceed the value of $1/R$. For instance, a transformer having a ratio of $R = 3$ must operate with peak loads equal to the full open delta capacity with a minimum load factor exceeding 33 per cent in order to justify closed delta connections. The peak load may, however, be less than the open delta capacity if the load factor is correspondingly greater than 33 per cent.

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READERS' FORUM

Purchasing Uncurtailed and Payroll Increased

To the Editor of the ELECTRICAL WORLD:

We are very much interested in the comments in your issue of April 16, 1932, in the Readers' Forum column wherein L. C. Angevine, superintendent of water and electricity at McPherson, Kan., covers the subject very thoroughly as to the attitude some electrical publications hold toward municipal electric light plants.

Our municipal plant in Norwalk and many other plants which I personally know have practically paid all outstanding indebtedness out of earnings and have, in the majority of cases, rates equal to and lower than those of privately owned corporations in cities comparable with the ones in question. Norwalk charges for street lighting $9,600 per year and the same amount of street lighting at the rates charged in cities of this size throughout northern Ohio would cost $14,000 per year. We have lighting rates and power rates considerably lower than other cities considerably larger in size and we have in our treasury as of April 1, 1932, $95,000 in cash. We as well as the people in McPherson, Kan., hate to be classed as bolsheviks, radicals and extreme socialists.

I too would like to see in your magazine a department for municipally owned utilities, where you make your own investigations and give credit where credit is due, as well as bring out other factors which are to the discredit of municipal plants, providing you do the same with privately owned corporations. During the present depression the municipally owned plants are the only ones purchasing all material on the same basis as was done prior to the depression, while privately owned corporations are notifying their purchasing agents to purchase only absolute necessities, and in small quantities at that. We have increased our payroll 30 per cent in order to help the unemployed, have had the larger force on for nearly one year and expect to add a few more during the summer. Private corporations are discharging men and have been doing so for the past two years, as we have many coming in here for work who have worked for some private corporation eighteen and twenty years and have been laid off on account of the depression.

These are factors the public is acquainted with here and I believe these conditions exist in other municipal plants.

M. G. IRVIN,
Superintendent.
Department of Electricity and Water,
City of Norwalk, Ohio.

Men of the Industry

W. A. Prendergast Elected Officer of Long Island Utility

William A. Prendergast, formerly chairman of the New York State Public Service Commission, has been elected a vice-president of the Long Island Lighting Company. Mr. Prendergast resigned as chairman of the New York commission more than two years ago, after establishing a reputation as one of the most capable commissioners in the country. A native of New York City, he entered upon a political career at a

rather early age and received the Republican nomination for Congress in his district in 1898. He was elected Register of Kings County in 1907 and Comptroller of the city in 1910, serving in the latter office for seven years. He served from 1921 to 1930 on the New York Public Service Commission and following his resignation became identified as a general partner in the banking and brokerage house of W. C. Langley & Company, New York. Mr. Prendergast is the author of several books on business and municipal subjects.

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C. E. Allen, commercial vice-president of the Westinghouse Electric & Manufacturing Company, has recently been elected a vice-president of the American Management Association. In addition to his duties with Westinghouse, where he is head of the various departments of the company devoted to the manufacture and sale of domestic electrical appliances, he will now be in charge of the consumer marketing division of the American Management Association. Mr. Allen entered the employ of the Westinghouse company in 1909 as head of the transformer division of the detail and supply department. Three years later he was appointed assistant to the manager of that department. For a short time in 1915 he was attached to the sales department of the New York district office, after which he was made manager of the supply division and central-station division of the Chicago office, which position he held until 1922, when he was appointed manager of the St. Louis district office. He was elected commercial vice-president in 1930.

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Thomas G. Dignan, manager of the Lowell Electric Light Corporation, has been designated temporary secretary of the New England Power Association, succeeding the late Richard S. Pattee. He will have charge of all corporate records. Mr. Dignan was formerly assistant general counsel of the association, and since December 1, 1930, has been operating manager of the Lowell company, one of the larger subsidiaries of the New England Power group.

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John M. Orts has been appointed director of the safety educational department of the Public Service Corporation of New Jersey, to succeed the late Allison J. Van Brunt. Mr. Orts has been associated with the Public Service organization for 28 years and has been assistant to the director of safety education since 1926. He is a member of the National Safety Council and the American Society of Safety Engineers.

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Dr. M. Luckiesh, director of the General Electric Lighting Research Laboratory at Nela Park, Cleveland, was recently appointed representative of the U. S. national committee on the technical committee on ultraviolet radiation of the International Commission on Illumination. The purpose of the committee is to define units and methods of measurement and appraisal of ultraviolet radiation. Dr. Luckiesh's appointment as representative is in recognition of his pioneering work on artificial sunlight, dual-purpose lighting and the general application of ultraviolet radiation for the benefit of civilization.

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Ernest W. Davis has been appointed electrical engineer of the Simplex Wire & Cable Company, Cambridge, Mass., succeeding W. I. Middleton, whose resignation on account of ill health was recently noted in the Electrical World. Mr. Davis was graduated in electrical engineering from the Massachusetts Institute of Technology in 1913 and has been connected with the Simplex organization ever since. He is chairman of technical committee No. 9 of the American Standards Association, a member of the American Institute of Electrical Engineers, International Power Cable Engineers Association and of the underground systems committee of the National Electric Light Association. He has written extensively on cable development and research.

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E. J. Steinberg New President of Wisconsin Association

E. J. Steinberg, service engineer of the Milwaukee Electric Railway & Light Company, has been elected president of the Wisconsin Utilities Association. Mr. Steinberg has been connected with the Milwaukee company since 1923 and for thirteen years prior to that con-

nection he had been identified with the Wisconsin Railroad Commission. It was in 1910 that he joined the commission engineering force in Madison. Three years later he was transferred to Milwaukee as resident engineer for the commission and in that capacity performed administrative and regulatory duties involving public utility properties in the Milwaukee district.

▼

Glenn D. Smith, manager of the Ontario district of the Southern California Edison Company, Ltd., has retired after a connection of many years with the electrical industry of Southern California. Frank Allen, assistant district manager at Ontario, has been appointed to succeed him. Mr. Smith held executive positions with the Ontario Power Company and the San Antonio Water Company before they became a part of the Edison company system. Previously, Mr. Smith was a resident of Michigan and one of the organizers of the Commonwealth Power Company in that state. Mr. Allen joined the Ontario Power Company organization in 1909 as a meter reader

and collector. He continued with the company in various capacities and in 1916, when the company conducted its first intensive electric range sales campaign, he was named to direct this activity. From 1916 he continued to supervise range and appliance sales, and also was in charge of new-business activities of the company. He became assistant district manager of the Ontario district when the Ontario company became part of the Edison system.

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R. B. CHAFFIN, formerly connected with the Richmond distribution department of the Virginia Electric & Power Company, has been appointed distribution superintendent at Fredericksburg. M. D. MINTON, superintendent of the Williamsburg distribution department, has been appointed to succeed Mr. Chaffin in Richmond.

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C. O. VON DANNENBERG, formerly connected with the Electric Management & Engineering Corporation, New York, as assistant electrical engineer, has recently joined the engineering department of the Pennsylvania Central Light & Power Company, Altoona.

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H. H. BARR, manager of the Bloomfield district of the Public Service Company of Indiana, has been transferred to the Princeton office, succeeding John Parrett, resigned. JOSEPH JARVIS, now manager of the Petersburg district, will succeed Mr. Barr at Bloomfield.

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T. JUSTIN MOORE, vice-president and general counsel of the Virginia Electric & Power Company, has joined the law firm of Hunton, Williams, Anderson & Gay, now known as Hunton, Williams, Anderson, Gay & Moore. Mr. Moore will continue in his present official capacity with the Virginia utility.

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CARL M. GILT, formerly outside plant engineer of the Brooklyn Edison Company, has been appointed assistant electrical engineer of that company. Mr. Gilt has been associated with the Brooklyn Edison organization since 1923, when he became test engineer after spending some time with the General Electric Company in the central-station department.

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VERN BEATS, for the past five years sales manager of the southern territory of the rural division of the Nebraska Power Company, Omaha, and for ten years prior to that associated with the Citizens' Power & Light Company, Council Bluffs, has been named manager of the Council Bluffs company to succeed Howard J. Butler, resigned. R. C. GEPPERT, general superintendent of the Nebraska Power Company for the past two years, had been appointed to a similar position with the Citizens' Power & Light Company. He had been assistant manager of the Council Bluffs unit from 1925 to 1928.

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F. A. Mitchell New President of Maryland Association

F. A. Mitchell, who was elected president of the Maryland Utilities Association, as announced in the April 16 issue

of the ELECTRICAL WORLD, has been secretary and treasurer of the Eastern Shore Public Service Company, Salisbury, Md., for the past four years. Except for the time of service overseas during the World War, Mr. Mitchell has been connected with the public utilities on the eastern shore of Maryland in various capacities. For a number of years he has been an officer of the Maryland Utilities Association and has been very active in its affairs.

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CARL V. DODGE, manager of roll and steel casting sales of the United Engineering & Foundry Company, has been elected a vice-president of the company. He has been identified with roll and steel casting production and sales of the company for 26 years.

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R. M. GARTH, who was distribution engineer for the Knoxville Power & Light Company and associated companies, the Tennessee Public Service Company and Holston River Electric Company, now has been made assistant electrical engineer, Navy Department, Bureau of Yards and Docks, Washington, D. C.

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PHILLIP J. DAVIS, formerly connected with the Niagara Hudson Power Corporation, has been appointed assistant manager of the Westchester County Lighting Company at White Plains, N. Y. Mr. Davis is the son of Herbert G. Davis, who for many years was associated with the Northern New York Utilities, Inc.

OBITUARY

DR. CARL LEO MEES, 79, president emeritus of Rose Polytechnic Institute, died at Terre Haute, Ind., April 19. He had been president of the institute for twenty years, before his retirement. Dr. Mees was a member of the American Institute of Electrical Engineers, the American Physics Society, the American Association for the Advancement of Science, Society for the Promotion of Engineering Education and the Indiana Academy of Science.

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LESLIE M. SHAW, financier, statesman, author and a member of the board of directors of the Cities Service Company since 1910, died March 28 at the Wardman Park Hotel, Washington, D. C., after a month's illness. Mr. Shaw served two terms as Governor of Iowa and as Secretary of the Treasury in President Roosevelt's Cabinet. He was born in Morristown, Vt., 84 years ago. His attention was centered on finance and in recent years he had devoted himself to writing on financial topics.

•

ALLAN V. GARRATT, noted hydraulic engineer and authority on waterwheel governing, and a former secretary of the National Electric Light Association, died at his home in Holliston, Mass., April 30. Mr. Garratt was born in Roxbury, Mass., 74 years ago and was educated at the Massachusetts Institute of Technology and Harvard. He was chairman of the first committee to draw up an electrical safety code and of the first committee on wire gage standards. The St. Louis World's Fair awarded him a gold medal for the most notable work in methods of waterwheel governing. He engaged in extensive electrical construction work in the State of Washington and for twenty years he was associated with the Lombard Governor Company of Boston and Ashland. For a time he was connected with Lockwood, Green Engineers, Inc.

•

G. A. EDWARD KOHLER, engineer, manufacturer and civic leader of Chicago, died April 29, at his home in that city, in his sixty-ninth year. At the time of his death his chief business interests centered in Kohler Brothers, electrical engineers, with offices in Chicago and New York City. He had a notable record in the printing trades for his invention, development and manufacture of devices used in the operation of newspaper presses. Another achievement was his perfection of the magazine reel, which made possible the changing of huge rolls of newsprint without stopping the presses. Among other business connections, he was chairman of the board of directors of the Kohler Aviation Corporation.

Trade News

D. C. Lindsay, formerly physicist of the Carrier Engineering Corporation and more recently publicity director for the Carrier Corporation of Newark, N. J., has been made sales promotion manager of Carrier-Brunswick International, Inc., a division of the Carrier Corporation.

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A new boiler catalog of 48 fully illustrated pages is now being distributed by the Foster-Wheeler Corporation, New York. This catalog, numbered bulletin B-32-3, describes the several different types of boilers manufactured in the corporation's shops.

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Hartford Steam Boiler Inspection & Insurance Company after spending a year in a temporary home has moved to its new office building at Prospect and Grove Streets, Hartford, Conn., the site previously occupied for nearly a quarter century. Modern in every respect, the new home is said to be the first in Hartford to be equipped with a complete air-heating, cooling and humidifying system.

•

Four new Eastern sales representatives have just been appointed by the Wolverine Tube Company of Detroit to handle its line of cable lugs and wire-splicing sleeves. In the Boston district A. H. Tutin, 131 Beverly street, Boston; in the New York district Kearton & Nagle, 550 West 36th street, New York City; in the Buffalo district R. W. Mitscher, Ellicott Square Building, Buffalo; in the Philadelphia district S. G. Cummings Company, 1616 Walnut Street, Philadelphia.

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Electromaster, Inc., announces the appointment of the Fernand Pincoffs Company of Los Angeles as distributor of Electrochef and Waldorf in southern California.

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James S. Watson, formerly vice-president in charge of Link-Belt Company's Dodge works, Indianapolis, has been appointed vice-president and general manager of both the Dodge and the Ewart works, the company's two Indianapolis chain factories, succeeding George P. Torrence, who was recently elevated to the presidency. C. Walter Spalding, who has been connected with the Ewart works for a number of years, has been appointed sales manager of Ewart plant products.

•

Formation of the Chamblin-Thomas Company, organized for the purpose of representing manufacturers of electrical merchandise, with headquarters at 639 Mission Street, San Francisco, has been officially announced by Clyde L. Chamblin and H. M. Thomas. The company will handle the line of sun lamps and floor lamps manufactured by the Luminator, Inc., Chicago, in northern California, and the Thomas A. Edison, Inc., line of "Edicraft" appliances throughout the state of California. In addition, it will serve as utility company representative of the Malleable Iron Range Company in California and will house at its salesroom at 639 Mission Street the most comprehensive display of Monarch electric ranges on the Pacific Coast.

•

James R. Kearney Corporation announces the appointment of W. M. Cory as its district representative with headquarters in Indianapolis. Mr. Cory has had extensive experience in all phases of the electrical industry and he is well known because of his previous connections. He was connected with Henry L. Doherty & Company in the Denver, Toledo and New York offices for a period of two years. After several years of experience with the Public Service Commission of Indiana and the Westinghouse Electric & Manufacturing Company he joined the sales organization of the Moloney Electric Company. He advanced to sales manager in that organization.

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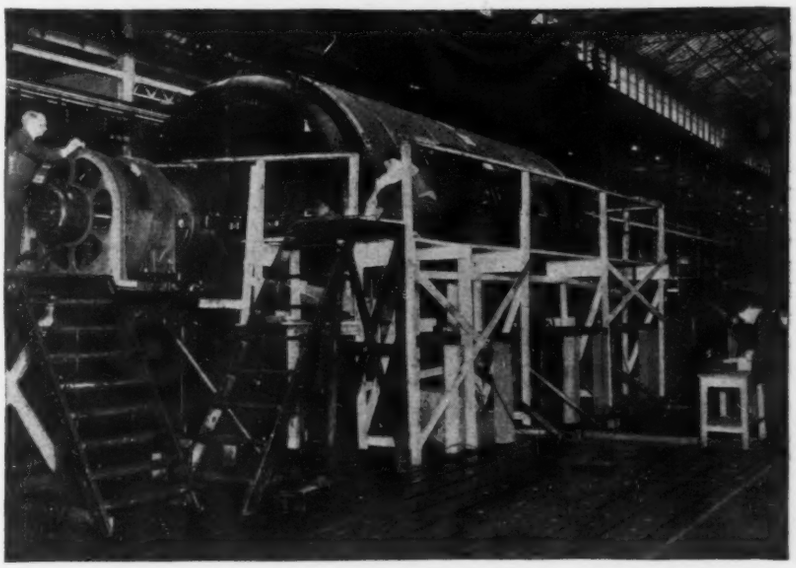
The illumination headquarters of the Westinghouse Electric & Manufacturing Company in Cleveland announces the appointment of W. H. Hyatt and I. P. Crevi as lighting division representatives for the New York territory with headquarters at 150 Broadway, New York City. This department, which was created April 1, will specialize in lighting activities, which at present are undergoing tremendous development in the United States. The new plan involves consistent promotion work throughout the entire territory, contacting principally all lighting service departments of the central stations, jobbers, contractor-dealers and all other important lighting prospects. Mr. Hyatt will be responsible for the sales development of street lighting, while Mr. Crevi will devote his time to commercial, industrial and floodlighting. Both of these men have had wide experience in the lighting field and are well known in the engineering and contracting trade.

▼

Stray Load Losses Determined by Test



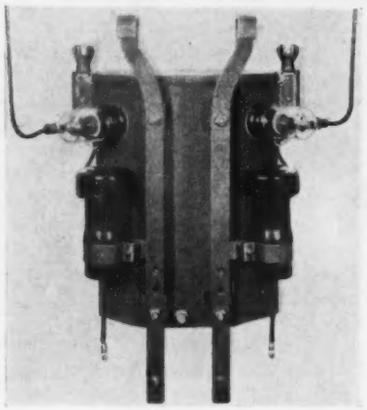
In determining the magnitude and distribution of iron and stray losses in various parts of the new 100,000-kva., 13.8-kv., 1,800-r.p.m. turbo-generator, now under construction for the Public Service Electric & Gas Company, Westinghouse engineers have largely eliminated empirical formulas and substituted special tests.

In these tests the generator is brought up to constant temperature under the load condition to be studied, including zero power factor, no load normal voltage and sustained short circuit. The field is then suddenly thrown off and the temperature of about 30 thermocouples imbedded in the parts to be studied are read at one-minute intervals for about 40 minutes. Knowing the specific heat of the material being studied and its rate of cooling at the instant the field is thrown off the loss by that particular part can be determined.

New Equipment Available

Surge Diverters for Distribution Transformers

Co-ordination of the transformer insulation so that the bushing will flash over before the windings fail gives surge-proof characteristics to a transformer, but sometimes when the bushing flashes



over a power arc may follow of sufficient magnitude to blow the primary fuses. The Allis-Chalmers Manufacturing Company announces surge diverters for application with their distribution transformers to eliminate this effect.

The surge diverter has been designed to function in less than 50 microseconds, so that it can be connected between the primary fuses and the transformer. This rapid action does not give time for the fuse to operate, so that fuse blowings are minimized. Surge diverters may be installed externally or inside the transformer case.

The flexibility in mounting makes it possible to connect the diverter either to separate ground connections or to secondary neutrals as desired.

▼

Starting Condenser for Capacitor Motors

A low-cost, high-capacity unit designed especially for starting purposes and designated as the "Aerovox" electrolytic starting condenser is announced by the Aerovox Wireless Corporation, Brooklyn, N. Y. This condenser is said to make possible the development of practical high-starting-torque capacitor motors. The units are designed for use with motors to be operated from 110-volt a.c. lines. They can be built in any desired capacities up to several hundred microfarads and are made in two types for light- or heavy-duty service. They are applied for starting only.

The condensers consist of several low-capacity sections connected in parallel to give the required over-all capacity. This increases the heat-dissipating area and results in a better product. Each section consists of two aluminum foils separated by an absorbent insulator completely saturated with a liquid electrolyte.

Some of the major advantages of the starting condensers are: Use of a special electrolyte which is a viscous solution and therefore entirely homogeneous; freedom from unabsorbed electrolyte in the completed condenser; since the electrolyte is a fluid, it is mobile, and capillary action causes it to diffuse itself throughout; the electrolyte has a low freezing point and high boiling point.

▼

Space Cooler Developed for Industrial Plants

A new development designed and constructed to meet the exacting requirements of the refrigerating industry known as the Grinnell unit cooler is announced by the Grinnell Company, Inc., Providence, R. I. It is a positive and revolutionary improvement over pipe coils or radiators for every variety of commercial cooling or refrigeration work, it is claimed.

It is used with direct-expansion ammonia, brine or other refrigerants. Some of the advantages claimed for this cooler are: Quicker cooling; positive and continuous air circulation; automatic defrosting; flexibility, sufficient to meet a wide variety of requirements; simplifies automatic control; reduces maintenance expense and has unusually long life.

In providing this new cooler great care has been taken to build it to specifications which will meet the most exacting requirements of refrigerating engineers.

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A COMBINATION REFRIGERATOR RANGE UNIT is offered by the Walker & Pratt Manufacturing Company, Boston, Mass. Some of the features are: The oven is equipped with balanced shelf type door; temperature is automatically controlled by mercury type oven temperature control; range is equipped with timer outlet and appliance outlet; the timer may be added at any time, etc.

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A NEW LOW-BED TRUCK, 5-ton capacity, front-wheel type, with a frame height of 21 in., has been put in production by the Four-Wheel Drive Auto Company of Clintonville, Wis. It is especially adaptable to hauling applications where hand loading or unloading is necessary, where the loads are bulky or the commodities fragile. The frame construction of this model is made up of two sections on different levels and joined together by gusset plates. This type of construction gives a straight, clear loading space from the back of the cab to the rear of the frame.

▼

Quick-Break Disconnecting Fuse Cartridge

A quick-break disconnecting fuse cartridge which fills a need in the low-amperage, low-capacity fuse field is announced by the James R. Kearney Corporation, St. Louis, Mo. It improves the characteristics of low-amperage fuses since its operation depends upon temperature rise and not upon the fusing point of a cross-section of metal, it is claimed. It can be more accurately controlled and, regardless of whether it operates under a short circuit or dragging overload, its interrupting time is the same.

The cartridge releases itself from the mounting so that no leakage currents can be established over the cartridge after the fuse has blown. This feature makes the location of the blown fuse easy for the trouble shooter.

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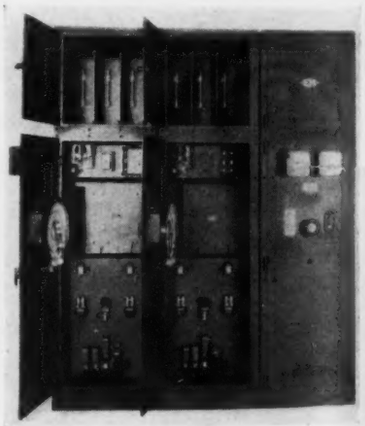
Cubicle Starter for Synchronous Motors

An improved cubicle starter for synchronous motors recently developed by the Electric Machinery Manufacturing Company, Minneapolis, Minn., uses a



front compartment for the meters, control relays, rheostat and field contactor, rear compartment for the oil-break line switches and upper compartment for the disconnects. The starter is designed to permit easy access to all working parts of the assembly.

Table I—Data on Output and
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Public utility, lighting, power and electri

Line No.	Company or System*	1931 Rank in 1931	1931 System Peak Load (30-Minute) Incl. Purchased Energy Kw. (See Note *a*)	1931 Peak Load on Generator Stations (30-Minute) Kw. (See Note *a*)	1931 Output for Year (Including Purchased Energy) Kw.-Hr.	1931 Average Load in Kw.	System Peak Load (Instantaneous) Kw. (See Note *a*)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(
1	Niagara Hudson Power Corporation System (*C*)	1	998,876	850,218	5,911,409,390	675,000		
2	The New York Edison System (*H*)	2	1,240,000	1,240,000	5,138,200,000	586,000	1,248,000	
3	Pacific Gas & Electric Company and all Subsidiaries	3	855,500		4,558,552,038	520,000		
4	Commonwealth Edison Company	4	(*b*) 902,500	616,550	4,226,257,000	482,000	1,030,900	
5	Southern California Edison Company, Ltd	5	558,200	554,900	3,061,836,977	349,500	582,900	
6	Philadelphia Electric Company System	6		668,000	3,032,323,879	346,000	(*G*) 699,000	(*G*)
7	Public Service Electric & Gas Company (N. J.)	7	462,700	366,500	2,170,512,600	247,800	540,500	
8	The Detroit Edison Company	8	477,700		2,170,254,600	247,700		
9	New England Power Association System*	9	(*o*) 484,000		1,987,327,572	226,800	438,800	
10	The North American Co. Sys. (Mo., Ill. and Iowa Group)	10	384,324		1,868,194,882	213,000	370,072	
11	Alabama Power Company	11	(*o*) 402,810		1,860,805,943	212,500		
12	Duke Power Company	12	412,000	322,000	1,768,184,411	201,800	421,000	
13	The West Penn Electric Company Subsidiaries	13	(*o*) 306,845		1,693,855,089	193,300		
14	Pennsylvania Power & Light Company	14	(*o*) 291,600	(*o*) 231,200	1,483,177,247	169,300		
15	The Ohio Power Company	15	242,000	326,000	1,456,252,361	166,200	262,000	
16	Duquesne Light Company	16	289,000	289,000	1,364,318,513	155,800	308,000	
17	Public Service Company of Northern Illinois	17	191,661	(*j*) 195,545	1,361,938,056	155,500		
18	Georgia Power Company	18	270,000		1,319,011,309	150,600	306,540	
19	The Cleveland Electric Illuminating Company	19	309,556		1,316,116,027	150,200	323,367	
20	Appalachian Electric Power Company (*E*)	20	231,730	234,000	1,276,642,108	145,700	280,600	
21	Super-Power Company of Illinois	21	236,700	231,800	1,253,830,208	143,100		
22	Columbia Gas & Electric Corporation System	22	266,540		1,162,409,020	132,700	262,000	
23	The North American Co. System (Wis.-Michigan Group)	23	261,322		1,125,840,103	128,500	276,586	
24	Northern States Power Company (Del.) Subsidiaries	24	227,971		1,064,002,895	121,500	233,533	
25	The Edison Electric Illuminating Company of Boston	25	281,787	231,210	1,048,605,842	119,700	289,017	
26	Consumers Power Company	26	242,700		1,016,384,395	116,000	254,731	
27	Chicago District Electric Generating Corporation	27	191,232	191,232	1,009,506,000	115,200	200,000	
28	The Montana Power Company	28	145,700	145,700	937,014,000	107,000	216,000	
29	Puget Sound Power & Light Company	29	185,630		911,955,295	104,100		
30	Consolidated Gas, Electric Light & Power Co. of Baltimore	30	(*o*) 181,500	(*o*) 162,500	884,250,577	100,900		
31	Ohio Edison Company	31			849,713,467	96,900		
32	The Washington Water Power Company	32	(*o*) 152,420	(*o*) 152,420	784,134,417	89,500		
33	The Tennessee Electric Power Company	33	165,000		762,528,751	87,000	158,155	
34	City of Los Angeles, Dept. of Water & Power	34	169,000	84,700	759,028,656	86,600	171,300	
35	Carolina Power & Light Company	35	(*o*) 217,000	(*o*) 171,300	731,648,290	83,500	190,500	
36	Assoc. Gas & Elec. System (Eastern Pa. & N. J. Group)* (*c*)	36	(*o*) 151,870	(*o*) 151,870	706,351,308	80,600	165,000	
37	Utah Power & Light Company	37	119,390	100,500	650,549,000	74,300	135,405	
38	Kansas City Power & Light Company	38	131,000		629,935,369	71,900		
39	Louisiana Power & Light Company	39	112,091	96,151	612,119,000	69,900	108,361	
40	Portland General Electric Company	40	(*o*) 130,900	(*o*) 130,400	603,182,100	68,800		
41	The Connecticut Electric Service Company System	41	(*o*) 115,241		552,059,756	63,000		
42	Virginia Electric & Power Company	42	107,600		534,628,983	61,000		
43	Houston Lighting & Power Company	43	(*o*) 96,210	(*o*) 93,100	524,913,000	59,900	107,235	
44	Texas Electric Service Company	44	(*o*) 86,190	(*o*) 82,720	521,669,355	59,500	73,933	
45	The North American Co. System (District of Columbia Group)	45	130,000	130,000	519,295,192	59,300	123,000	
46	Pennsylvania Water & Power Company	46	(*o*) 126,500	(*o*) 126,500	506,218,600	57,800	132,000	
47	Illinois Power & Light Corporation (Illinois)	47	99,000		506,145,010	57,800		
48	Indiana & Michigan Electric Company	48	126,160	95,620	491,439,695	56,100	120,860	
49	Oklahoma Gas & Electric Company	49	99,494	95,530	489,174,640	55,800	117,320	
50	The California Oregon Power Company	50	92,425	81,760	465,156,805	53,100	83,540	
51	Ohio Public Service Company	51	(*o*) 103,200	(*o*) 71,000	455,840,667	52,000		
52	Toledo Edison Company	52	(*o*) 107,030	(*o*) 95,000	452,178,712	51,600		
53	Idaho Power Company	53	(*o*) 68,857	(*o*) 66,440	450,864,575	51,500		
54	Louisville Gas & Electric Company (Del.) Subsidiaries	54			450,407,520	51,400	91,235	
55	Central Indiana Power Company Subsidiaries	55	90,750	68,100	448,574,681	51,200		
56	Texas Power & Light Company	56	(*o*) 105,225	(*o*) 89,890	445,325,000	50,800	101,000	
57	Western Massachusetts Companies System	57	86,100	85,100	443,000,000	50,500	93,100	
58	Central Maine Power Company System	58	(*o*) 88,070		440,667,827	50,300		
59	Montaup Electric Company	59	89,800	77,940	435,364,000	49,700	96,000	
60	N. Y. State Elec. & Gas Corp. Group (Assoc. G. & E. System)	60	(*o*) 89,500	(*o*) 33,500	430,009,374	49,100		
61	Los Angeles Gas & Electric Corporation	61	115,900	115,900	429,006,384	48,970	115,000	
62	Assoc. Gas & Elec. System (South Carolina Group)* (*h*)	62	(*o*) 123,900	(*o*) 123,900	425,907,556	48,600	68,000	
63	Northern Indiana Public Service Company	63	76,650		423,230,408	48,300		
64	Assoc. Gas & Elec. System (West. Penna. Group)* (*i*)	64	(*o*) 84,300	(*o*) 84,000	411,565,334	46,900		
65	Minnesota Power & Light Company	65	(*o*) 86,870	(*o*) 86,870	391,586,638	44,700		
66	Hartford Electric Light Company	66	(*o*) 80,000	(*o*) 83,000	368,970,842	42,200		
67	Rochester Gas & Elec. Corp. Group (Assoc. G. & E. System)	67	(*o*) 72,727	(*o*) 71,227	366,281,440	41,800	86,926	
68	Westchester Lighting Company	68	58,328	0	357,430,320	40,800	56,580	
69	City of Seattle, Dept. of Lighting	69	90,000	90,000	353,764,500	40,400	89,500	
70	U. S. Government (Muscle Shoals)	70	161,634	(*t*) 162,034	345,603,400	39,400	148,000	
71	Nebraska Power Company	71	(*o*) 70,600	(*o*) 70,600	345,568,500	39,400	68,000	
72	Indianapolis Power & Light Company	72	76,500	61,900	344,025,888	39,300		
73	Central Illinois Public Service Company	73	83,000		342,162,436	39,100		
74	New Orleans Public Service Inc.	74	74,000	74,000	341,034,400	38,900	71,500	
75	Public Service Company of Indiana*	75	72,588	40,775	320,594,122	36,600		
76	Public Service Company of Colorado	76	(*o*) 71,783	(*o*) 71,783	318,427,572	36,350		
77	The Yonkers Electric Light & Power Company	77	(*b*) 17,271	0	317,666,263	36,300		(See
78	Hetch Hetchy Water Supply, City & County of San Francisco	78	83,600	83,600	309,450,010	35,300		
79	Arkansas Power & Light Company	79	62,500	28,300	304,690,000	34,800	67,000	
80	Salt River Valley Water Users' Association	80		63,160	292,324,270	33,400	53,370	
81	Northwestern Electric Company	81	(*o*) 54,440	(*o*) 50,400	287,290,707	32,800		
82	Wisconsin Power & Light Company	82	66,380	61,480	284,597,748	32,500	68,000	

Supplement to ELECTRICAL WORLD, May 7, 1932

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d Peak Load of Largest Generating and Distributing
in North America, 1925—1931

ectric railway systems in the United States, Canada and Mexico having output in excess of 100,000,000 kw.-hr. during 1931

1930				1929				1928			1927	
	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (9)	Output for Year (Including Purchased Energy) Kw.-Hr. (10)	Average Load in Kw. (11)	System Peak Load (Instantaneous) Kw. (See Note *a*) (12)	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (13)	Output for Year (Including Purchased Energy) Kw.-Hr. (14)	Average Load in Kw. (15)	System Peak Load (Instantaneous) Kw. (See Note *a*) (16)	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (17)	Output for Year (Including Purchased Energy) Kw.-Hr. (18)	System Peak Load (Instantaneous) Kw. (See Note *a*) (19)	
	1,091,910	6,892,316,698	786,600	1,148,600	.....	7,212,743,072	823,400	.....	.....	.....	.....	
	1,226,000	4,983,500,000	568,800	1,225,000	1,209,000	4,678,700,000	534,000	1,146,000	1,125,000	4,210,700,000	784,077	
	853,300	4,546,499,302	519,000	513,800	.....	2,717,874,472	310,000	484,600	.....	2,545,713,564	439,568	
	969,800	4,582,510,000	523,100	1,028,500	1,000,200	4,636,434,000	529,000	1,050,000	1,016,000	4,174,661,000	952,000	
	.....	3,168,973,397	361,000	571,000	.....	3,162,988,030	361,000	516,100	.....	2,762,459,843	448,900	
	(*G*) 670,000	3,091,233,131	352,900	(*G*) 740,000	(*G*) 713,000	3,029,885,631	346,000	581,000	561,400	2,266,856,345	455,000	
	506,500	2,173,944,354	248,000	536,600	517,225	2,134,581,298	243,600	480,500	471,000	1,879,024,063	435,500	
	526,800	2,384,528,500	272,000	.....	547,600	2,654,901,300	303,000	509,300	507,700	2,438,304,900	447,500	
	411,000	1,590,215,715	181,500	406,300	395,000	1,703,536,819	194,400	.....	315,000	1,384,834,239	(*o*) 243,650	
	.....	1,954,460,032	223,000	350,000	.....	1,871,797,392	213,500	355,611	.....	1,719,825,708	319,599	
	416,750	1,707,945,749	195,000	.....	376,400	1,715,250,122	195,600	.....	338,600	1,586,177,553	(*n*) 248,280	
	421,000	1,762,798,306	201,000	432,000	432,000	1,981,239,709	226,000	422,600	422,600	1,847,072,621	(*n*) 398,300	
	345,720	1,875,470,490	214,000	.....	362,787	1,938,955,818	221,000	.....	319,325	1,764,742,160	(*o*) 332,405	
	298,500	1,443,264,200	164,750	.....	285,800	1,251,104,868	142,800	253,000	.....	1,176,653,000	203,002	
	.....	1,479,180,000	168,900	276,000	.....	1,544,252,000	176,000	224,000	.....	1,305,004,000	211,000	
	304,000	1,510,950,299	172,480	.....	.....	1,573,445,327	179,200	295,300	.....	1,434,185,024	276,900	
	186,869	1,361,763,671	155,300	.....	190,123	1,246,330,283	142,100	.....	178,016	1,047,466,830	(*n*, *G*) 154,044	
	301,955	1,364,739,226	155,800	.....	257,125	1,146,516,743	130,900	.....	223,700	909,962,847	(*n*) 185,000	
	.....	1,370,467,732	156,300	315,870	.....	1,447,193,594	165,000	331,768	.....	1,282,476,855	293,731	
	.....	1,613,396,000	184,100	265,000–	.....	1,484,761,000	169,300	230,000	.....	1,270,328,000	216,000	
	158,400	729,805,500	83,250	.....	.....	.....	.....	.....	.....	.....	.....	
	262,000	1,161,459,375	132,300	263,000	261,000	1,203,652,405	137,400	252,000	249,000	1,052,549,327	213,000	
	.....	1,243,228,676	141,900	284,359	.....	1,311,738,004	149,000	262,860	.....	1,148,886,380	229,314	
	210,000	1,024,205,047	116,900	.....	.....	969,071,015	110,700	.....	.....	908,760,906	.....	
	.....	1,073,796,288	122,500	275,501	.....	1,041,388,668	118,900	252,777	.....	857,209,496	224,508	
	248,000	1,072,090,387	122,500	271,052	270,772	1,198,947,711	137,000	232,980	230,000	1,102,278,322	225,919	
	198,324	1,039,422,000	118,500	165,400	163,900	(*I*) 430,779,000	(*I*) 97,500	.....	.....	.....	.....	
	216,000	1,293,449,000	147,600	.....	229,800	1,611,521,000	184,000	.....	.....	1,583,985,000	191,100	
	192,623	980,325,415	111,900	193,392	.....	941,992,205	107,500	169,219	.....	877,953,546	158,453	
	188,200	933,093,920	106,500	.....	186,000	910,934,486	104,000	.....	167,900	825,430,643	(*o*) 165,000	
	.....	980,578,309	112,000	.....	.....	.....	.....	.....	.....	.....	.....	
	155,960	850,025,000	97,000	.....	172,735	858,353,000	97,900	.....	.....	746,709,000	128,120	
	150,965	783,433,211	89,500	165,000	157,600	819,723,857	93,500	152,200	145,300	730,061,103	137,800	
	170,000	759,852,996	86,600	162,000	161,000	722,998,796	82,500	153,200	152,000	639,415,709	133,300	
	188,000	564,056,174	64,400	.....	108,000	476,878,300	54,400	107,000	.....	430,427,600	101,000	
	158,140	725,194,632	82,750	165,000	158,320	735,612,022	83,900	150,000	143,500	645,621,149	140,000	
	.....	746,475,000	85,200	.....	142,505	882,360,000	100,700	132,390	.....	830,862,000	118,678	
	136,200	647,940,872	73,960	139,400	132,400	645,165,032	73,600	127,300	120,300	584,714,544	120,806	
	108,361	596,413,000	68,000	.....	110,464	511,225,000	58,300	92,553	.....	390,533,000	.....	
	128,000	589,240,400	67,300	.....	123,600	603,423,300	68,800	.....	128,500	549,922,100	(*o*) 120,900	
	115,629	568,625,609	64,800	.....	123,915	580,426,439	66,250	.....	.....	445,804,848	.....	
	108,100	514,453,563	58,700	105,000	101,800	480,970,175	54,800	.....	95,100	440,886,606	(*n*) 88,200	
	103,900	566,409,000	64,700	.....	96,205	510,247,000	58,200	82,600	.....	436,633,000	75,000	
	71,780	568,018,000	64,800	.....	.....	665,625,000	76,000	67,494	.....	381,404,000	.....	
	.....	488,533,981	55,800	120,000	118,000	449,794,685	51,300	110,500	108,000	413,992,663	101,000	
	127,900	527,694,000	60,240	134,000	129,600	610,962,200	69,750	129,000	124,500	655,035,700	127,000	
	102,050	533,762,511	60,900	.....	108,300	542,629,220	61,900	.....	105,000	491,171,956	.....	
	.....	530,316,000	60,500	106,190	.....	538,734,000	61,400	91,560	.....	454,600,000	90,110	
	114,500	643,486,718	73,450	.....	.....	692,070,936	79,000	.....	.....	567,869,411	.....	
	.....	476,173,234	54,300	94,575	.....	410,083,711	46,800	.....	.....	441,845,615	.....	
	118,300	553,277,582	63,100	.....	114,900	611,482,217	69,800	.....	111,800	559,090,541	(*o*) 98,700	
	123,230	468,679,050	53,400	.....	123,700	514,989,108	58,700	.....	100,020	458,973,651	(*o*) 81,400	
	70,130	482,065,456	55,000	.....	71,114	471,732,000	53,800	72,080	.....	506,009,000	70,245	
	.....	348,598,452	39,800	.....	.....	328,598,520	37,500	.....	.....	285,767,900	.....	
	99,070	441,309,468	50,300	.....	93,170	424,300,963	48,400	.....	84,205	383,337,429	74,100	
	98,405	440,721,000	50,300	.....	102,780	442,818,000	50,500	92,620	.....	374,563,000	84,200	
	93,100	476,000,000	54,300	.....	105,100	494,805,982	56,400	.....	.....	.....	.....	
	69,200	295,981,170	33,790	.....	53,045	270,606,693	30,900	53,200	53,200	240,169,182	(*o*) 48,600	
	90,200	374,034,000	42,700	112,000	101,000	338,215,600	38,600	.....	.....	.....	.....	
	.....	444,904,828	50,800	.....	.....	377,746,958	43,100	.....	.....	.....	.....	
	115,000	388,312,942	44,300	90,000	90,000	304,100,629	34,700	81,500	81,500	269,681,600	74,000	
	65,100	178,976,937	20,400	55,000	53,200	162,129,679	18,500	60,000	54,800	148,932,217	.....	
	68,740	370,866,979	42,300	.....	66,928	334,913,629	38,200	.....	52,094	302,031,809	(*n*) 44,990	
	95,823	456,913,135	52,150	.....	87,736	427,848,189	48,800	80,696	.....	416,134,000	77,950	
	59,800	396,238,000	45,200	.....	55,900	362,855,320	41,500	.....	52,500	242,563,000	(*n*, *G*) 51,300	
	78,008	387,454,655	44,200	91,523	83,023	393,506,327	44,900	84,900	75,290	376,764,523	80,150	
	56,482	283,625,262	32,300	50,600	50,200	216,503,601	24,700	45,200	45,150	171,315,819	(See the N. Y. E	
	89,000	384,812,680	43,480	90,000	80,000	364,959,930	41,600	76,800	75,000	307,909,700	75,000	
	145,092	306,119,200	34,900	116,260	112,500	171,681,600	19,500	130,000	120,600	222,096,800	125,540	
	65,000	320,411,600	36,500	.....	55,000	265,901,500	30,300	47,000	.....	219,813,000	41,900	
	78,600	374,997,370	42,800	.....	82,800	388,871,320	44,400	76,600	76,600	356,228,046	(*n*) 63,500	
	87,500	366,474,373	41,800	.....	86,300	367,912,947	41,900	.....	66,300	339,189,800	(*n*) 72,600	
	70,100	350,484,000	40,000	.....	68,000	345,847,000	39,500	68,000	.....	338,629,000	66,500	
	73,682	331,467,254	37,800	.....	72,453	319,607,394	36,400	67,797	.....	298,387,145	(*o*) 63,980	
e	e the N. Y. Edison & Allied Cos.)											
	83,600	493,888,420	56,250	83,400	83,400	464,339,110	53,000	82,400	82,400	528,895,495	.....	
	66,100	331,538,000	37,800	.....	.....	310,955,000	35,500	.....	.....	259,164,000	.....	
	.....	276,816,917	31,400	46,315	.....	188,665,617	21,500	55,200	.....	275,550,594	53,275	
	54,160	278,947,541	31,800	.....	56,000	286,529,056	32,700	53,100	.....	286,820,000	48,100	
	67,600	292,252,317	33,300	61,000	60,784	296,527,833	33,900	.....	.....	283,520,629	(*N*)	
										275,965,650		

Supplement to ELECTRICAL WORLD, May 7, 1932

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Data on Output and Peak Load of Largest Genera in North America, 1925—1931

Public utility, lighting, power and electric railway systems in the United States, Canada and Mexico having output in excess of

1931				1930				1929			
em Load nute) rchased gy w. ote *a*)	Peak Load on Generator Stations (30-Minute) Kw. (See Note *a*) (5)	Output for Year (Including Purchased Energy) Kw.-Hr. (6)	Average Load in Kw. (7)	System Peak Load (Instantaneous) Kw. (See Note *a*) (8)	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (9)	Output for Year (Including Purchased Energy) Kw.-Hr. (10)	Average Load in Kw. (11)	System Peak Load (Instantaneous) Kw. (See Note *a*) (12)	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (13)	Output for Year (Including Purchased Energy) Kw.-Hr. (14)	Average Load in Kw. (15)
98,876	850,218	5,911,409,390	675,000	.....	1,091,910	6,892,316,698	786,600	1,148,600	.....	7,212,743,072	823,400
40,000	1,240,000	5,138,200,000	586,000	1,248,000	1,226,000	4,983,500,000	568,800	1,225,000	1,209,000	4,678,700,000	534,000
55,500	.....	4,558,552,038	520,000	.....	853,300	4,546,499,302	519,000	513,800	.....	2,717,874,472	310,000
02,500	616,550	4,226,257,000	482,000	1,030,900	969,800	4,582,510,000	523,100	1,028,500	1,000,200	4,636,434,000	529,000
58,200	554,900	3,061,836,977	349,500	582,900	.....	3,168,973,397	361,000	571,000	.....	3,162,988,030	361,000
.....	668,000	3,032,323,879	346,000	(*G*) 699,000	(*G*) 670,000	3,091,233,131	352,900	(*G*) 740,000	(*G*) 713,000	3,029,885,631	346,000
62,700	366,500	2,170,512,600	247,800	540,500	506,500	2,173,944,354	248,000	536,600	517,225	2,134,581,298	243,600
77,700	.....	2,170,254,600	247,700	.....	526,800	2,384,528,500	272,000	.....	547,600	2,654,901,300	303,000
84,000	.....	1,987,327,572	226,800	438,800	411,000	1,590,215,715	181,500	406,300	395,000	1,703,536,819	194,400
84,324	.....	1,868,194,882	213,000	370,072	.....	1,954,460,032	223,000	350,000	.....	1,871,797,392	213,500
02,810	.....	1,860,805,943	212,500	.....	416,750	1,707,945,749	195,000	.....	376,400	1,715,250,122	195,600
12,000	322,000	1,768,184,411	201,800	421,000	421,000	1,762,798,306	201,000	432,000	432,000	1,981,239,709	226,000
06,845	.....	1,693,855,089	193,300	.....	345,720	1,875,470,490	214,000	.....	362,787	1,938,955,818	221,000
91,600	(*o*) 231,200	1,483,177,247	169,300	.....	298,500	1,443,264,200	164,750	.....	285,800	1,251,104,868	142,800
42,000	326,000	1,456,252,361	166,200	262,000	.....	1,479,180,000	168,900	276,000	.....	1,544,252,000	176,000
89,000	289,000	1,364,318,513	155,800	308,000	304,000	1,510,950,299	172,480	.....	.....	1,573,445,327	179,200
91,661	(*j*) 195,545	1,361,938,056	155,500	.....	186,869	1,361,763,671	155,300	.....	190,123	1,246,330,283	142,100
70,000	.....	1,319,011,309	150,600	306,540	301,955	1,364,739,226	155,800	.....	257,125	1,146,516,743	130,900
09,556	.....	1,316,116,027	150,200	323,367	.....	1,370,467,732	156,300	315,870	.....	1,447,193,594	165,000
31,730	234,000	1,276,642,108	145,700	280,600	.....	1,613,396,000	184,100	265,000–	.....	1,484,761,000	169,300
36,700	231,800	1,253,830,208	143,100	.....	158,400	729,805,500	83,250	.....	.....	.....	.....
66,540	.....	1,162,409,020	132,700	262,000	262,000	1,161,459,375	132,300	263,000	261,000	1,203,652,405	137,400
61,322	.....	1,125,840,103	128,500	276,586	.....	1,243,228,676	141,900	284,359	.....	1,311,738,004	149,000
27,971	.....	1,064,002,895	121,500	233,533	210,000	1,024,205,047	116,900	.....	.....	969,071,015	110,700
81,787	231,210	1,048,605,842	119,700	289,017	.....	1,073,796,288	122,500	275,501	.....	1,041,388,668	118,900
42,700	.....	1,016,384,395	116,000	254,731	248,000	1,072,090,387	122,500	271,052	270,772	1,198,947,711	137,000
91,232	191,232	1,009,506,000	115,200	200,000	198,324	1,039,422,000	118,500	165,400	163,900	(*I*) 430,779,000	(*I*) 97,500
45,700	145,700	937,014,000	107,000	216,000	216,000	1,293,449,000	147,600	.....	229,800	1,611,521,000	184,000
85,630	.....	911,955,295	104,100	.....	192,623	980,325,415	111,900	193,392	.....	941,992,205	107,500
81,500	(*o*) 162,500	884,250,577	100,900	.....	188,200	933,093,920	106,500	.....	186,000	910,934,486	104,000
.....	.....	849,713,467	96,900	.....	.....	980,578,309	112,000	.....	.....	.....	.....
52,420	(*o*) 152,420	784,134,417	89,500	.....	155,960	850,025,000	97,000	.....	172,735	858,353,000	97,900
65,000	.....	762,528,751	87,000	158,155	150,965	783,433,211	89,500	165,000	157,600	819,723,857	93,500
69,000	84,700	759,028,656	86,600	171,300	170,000	759,852,996	86,600	162,000	161,000	722,998,796	82,500
17,000	(*o*) 171,300	731,648,290	83,500	190,500	188,000	564,056,174	64,400	.....	108,000	476,878,300	54,400
51,870	(*o*) 151,870	706,351,308	80,600	165,000	158,140	725,194,632	82,750	165,000	158,320	735,612,022	83,900
19,390	100,500	650,549,000	74,300	135,405	.....	746,475,000	85,200	.....	142,505	882,360,000	100,700
31,000	.....	629,935,369	71,900	.....	136,200	647,940,872	73,960	139,400	132,400	645,165,032	73,600
12,091	96,151	612,119,000	69,900	108,361	108,361	596,413,000	68,000	.....	110,464	511,225,000	58,300
30,900	(*o*) 130,400	603,182,100	68,800	.....	128,000	589,240,400	67,300	.....	123,600	603,423,300	68,800
15,241	.....	552,059,756	63,000	.....	115,629	568,625,609	64,800	.....	123,915	580,426,439	66,250
07,600	.....	534,628,983	61,000	.....	108,100	514,453,563	58,700	105,000	101,800	480,970,175	54,800
96,210	(*o*) 93,100	524,913,000	59,900	107,235	103,900	566,409,000	64,700	.....	96,205	510,247,000	58,200
86,190	(*o*) 82,720	521,669,355	59,500	73,933	71,780	568,018,000	64,800	.....	.....	665,625,000	76,000
30,000	130,000	519,295,192	59,300	123,000	.....	488,533,981	55,800	120,000	118,000	449,794,685	51,300
26,500	(*o*) 126,500	506,218,600	57,800	132,000	127,900	527,694,000	60,240	134,000	129,600	610,962,200	69,750
99,000	.....	506,145,010	57,800	.....	102,050	533,762,511	60,900	.....	108,300	542,629,220	61,900
26,160	95,620	491,439,695	56,100	120,860	.....	530,316,000	60,500	106,190	.....	538,734,000	61,400
99,494	95,530	489,174,640	55,800	117,320	114,500	643,486,718	73,450	.....	.....	692,070,936	79,000
92,425	81,760	465,156,805	53,100	83,540	.....	476,173,234	54,300	94,575	.....	410,083,711	46,800
03,200	(*o*) 71,000	455,840,667	52,000	.....	118,300	553,277,582	63,100	.....	114,900	611,482,217	69,800
07,030	(*o*) 95,000	452,178,712	51,600	.....	123,230	468,679,050	53,400	.....	123,700	514,989,108	58,700
68,857	(*o*) 66,440	450,864,575	51,500	.....	70,130	482,065,456	55,000	.....	71,114	471,732,000	53,800
.....	.....	450,407,520	51,400	91,235	.....	348,598,452	39,800	.....	.....	328,598,520	37,500
90,750	68,100	448,574,681	51,200	.....	99,070	441,309,468	50,300	.....	93,170	424,300,963	48,400
05,225	(*o*) 89,890	445,325,000	50,800	101,000	98,405	440,721,000	50,300	.....	102,780	442,818,000	50,500
86,100	85,100	443,000,000	50,500	93,100	93,100	476,000,000	54,300	.....	105,100	494,805,982	56,400
88,070	.....	440,667,827	50,300	.....	69,200	295,981,170	33,790	.....	53,045	270,606,693	30,900
89,800	77,940	435,364,000	49,700	96,000	90,200	374,034,000	42,700	112,000	101,000	338,215,600	38,600
89,500	(*o*) 33,500	430,009,374	49,100	.....	.....	444,904,828	50,800	.....	.....	377,746,958	43,100
15,900	115,900	429,006,384	48,970	115,000	115,000	388,312,942	44,300	90,000	90,000	304,100,629	34,700
23,900	(*o*) 123,900	425,907,556	48,600	68,000	65,100	178,976,937	20,400	55,000	53,200	162,129,679	18,500
76,650	.....	423,230,408	48,300	.....	68,740	370,866,979	42,300	.....	66,928	334,913,629	38,200
84,300	(*o*) 84,000	411,565,334	46,900	.....	.....	.....	.....	.....	.....	.....	.....
86,870	(*o*) 86,870	391,586,638	44,700	.....	95,825	456,913,135	52,150	.....	87,736	427,848,189	48,800
80,000	(*o*) 83,000	368,970,842	42,200	.....	59,800	396,238,000	45,200	.....	55,900	362,855,320	41,500
72,727	(*o*) 71,227	366,281,440	41,800	86,926	78,008	387,454,655	44,200	91,523	83,023	393,506,327	44,900
58,328	0	357,430,320	40,800	56,580	56,482	283,625,262	32,300	50,600	50,200	216,503,601	24,700
90,000	90,000	353,764,500	40,400	89,500	89,000	384,812,680	43,480	90,000	80,000	364,959,930	41,600
61,634	(*t*) 162,034	345,603,400	39,400	148,000	145,092	306,119,200	34,900	116,260	112,500	171,681,600	19,500
70,600	(*o*) 70,600	345,568,500	39,400	68,000	65,000	320,411,600	36,500	.....	55,000	265,901,500	30,300
76,500	61,900	344,025,888	39,300	.....	78,600	374,997,370	42,800	.....	82,800	388,871,320	44,400
83,000	.....	342,162,436	39,100	.....	87,500	366,474,373	41,800	.....	86,300	367,912,947	41,900
74,000	74,000	341,034,400	38,900	71,500	70,100	350,484,000	40,000	.....	68,000	345,847,000	39,500
72,588	40,775	320,594,122	36,600	.....	.....	.....	.....	.....	.....	.....	.....
71,783	(*o*) 71,783	318,427,572	36,350	.....	73,682	331,467,254	37,800	.....	72,453	319,607,394	36,400
17,271	0	317,666,263	36,300	(See the N. Y. Edison & Allied Cos.)							
83,600	83,600	309,450,010	35,300	.....	83,600	493,888,420	56,250	83,400	83,400	464,339,110	53,000
62,500	28,300	304,690,000	34,800	67,000	66,100	331,538,000	37,800	.....	.....	310,955,000	35,500
.....	63,160	292,324,270	33,400	53,370	.....	276,816,917	31,400	46,315	.....	188,665,617	21,500
54,440	(*o*) 50,400	287,290,707	32,800	.....	54,160	278,947,541	31,800	.....	56,000	286,529,056	32,700
65,280	61,480	284,597,748	32,500	68,000	67,600	292,252,317	33,300	61,000	60,784	296,527,833	33,900

57	Western Massachusetts Companies System	57	86,100	85,100	443,000,000	50,500	93,100	9
58	Central Maine Power Company System	58	(*o*) 88,070	.....	440,667,827	50,300	.....	6
59	Montaup Electric Company	59	89,800	77,940	435,364,000	49,700	96,000	9

rating and Distributing Systems

s of 100,000,000 kw.-hr. during 1931

	1928			1927		1926		1925		
	System Peak Load (Instantaneous) Kw. (See Note *a*) (16)	System Peak Load (Over 30-Minute Period) Kw. (See Note *a*) (17)	Output for Year (Including Purchased Energy) Kw.-Hr. (18)	System Peak Load (Instantaneous) Kw. (See Note *a*) (19)	Output for Year (Including Purchased Energy) Kw.-Hr. (20)	Peak Load (Instantaneous) Kw. (See Note *a*) (21)	Output for Year Kw.-Hr. (22)	Peak Load (Instantaneous) Kw. (See Note *a*) (23)	Output for Year Kw.-Hr. (24)	Line No. (25)
3,400										1
4,000	1,146,000	1,125,000	4,210,700,000	784,077	2,877,090,621	731,964	2,554,025,704	656,312	2,262,620,409	2
0,000	484,600		2,545,713,564	439,568	2,322,015,035	406,970	2,157,886,980	380,084	2,001,474,640	3
9,000	1,050,000	1,016,000	4,174,661,000	952,000	3,778,380,000	897,000	3,482,632,000	809,000	3,091,424,000	4
1,000	516,100		2,762,459,843	448,900	2,421,357,098	422,700	2,227,879,772	395,900	1,987,661,654	5
6,000	581,000	561,400	2,266,856,345	455,000	1,860,613,091	444,000	1,749,016,316	387,200	1,521,639,979	6
3,600	480,500	471,000	1,879,024,063	435,500	1,701,886,359	415,000	1,560,801,782	367,048	1,358,318,172	7
3,000	509,300	507,700	2,438,304,900	447,500	2,142,549,100	439,000	2,025,063,700	391,000	1,732,420,700	8
4,400		315,000	1,384,834,239	(*o*) 243,650	1,104,515,942	(*o*) 179,200	716,087,950	(*o*) 165,200	681,696,046	9
3,500	355,611		1,719,825,708	319,599	1,449,881,883	278,121	1,337,733,243	258,623	1,200,506,087	10
6,600		338,600	1,586,177,553	(*n*) 248,280	1,759,143,119					11
6,000	422,600	422,600	1,847,072,621	(*n*) 398,300	1,745,776,428	(*o*) 337,040	1,433,759,975	(*o*) 297,705	1,187,872,330	12
1,000		319,325	1,764,742,160	(*o*) 332,405	1,727,565,353	(*o*) 313,040	1,514,609,984		1,316,521,920	13
2,800	253,000		1,176,653,000	203,002	908,579,200	194,402	858,001,300	130,403	707,995,258	14
6,000	224,000		1,305,004,000	211,000	1,131,133,000	202,000	1,109,315,094	(*n*) 181,600	890,509,813	15
9,200	295,300		1,434,185,024	276,900	1,328,526,578	284,260	1,332,033,978	271,200	1,230,292,597	16
2,100		178,016	1,047,466,830	(*n*, *G*) 154,044	884,762,116	(*n*, *G*) 139,809	720,018,554	(*d*) 166,390	(*f*) 615,092,925	17
0,900		223,700	909,962,847	(*n*) 185,000	697,306,888					18
6,000	331,768		1,282,476,855	293,731	1,138,838,831	287,119	1,118,294,193	251,375	989,409,700	19
9,300	230,000		1,270,328,000	216,000	1,095,378,000	205,000	975,664,102			20
										21
7,400	252,000	249,000	1,052,549,327	213,000	936,704,222					22
9,000	262,860		1,148,886,380	229,314	1,026,886,645	210,420	959,430,412	203,904	849,064,272	23
0,700			908,760,906		839,375,628	181,677	805,380,692	168,659	742,601,203	24
8,900	252,777		857,209,496	224,508	748,502,053	190,276	673,760,354	203,199	648,078,358	25
7,000	232,980	230,000	1,102,278,322	225,919	930,285,847	118,113	809,134,896	157,332	686,548,440	26
7,500										27
4,000			1,583,985,000	191,100	1,366,997,834	188,400	1,379,194,095	172,600	1,234,052,127	28
7,500	169,219		877,953,546	158,453	787,258,688	135,665	708,450,887	131,468	632,626,358	29
4,000		167,900	825,430,643	(*o*) 165,000	786,877,691	(*o*) 162,500	802,768,634	(*o*) 160,700	718,195,433	30
										31
7,900			746,709,000	128,120	633,019,740	103,783	571,833,994	107,030	515,523,750	32
3,500	152,200	145,300	730,061,103	137,800	651,397,468	136,800	653,812,207	155,000	654,488,668	33
2,500	153,200	152,000	639,415,709	133,300	584,279,702	121,700	521,136,258	109,860	479,878,822	34
4,400	107,000		430,427,600	101,000	426,426,000	(*L*) 95,000	(*L*) 426,399,670	46,000	160,646,601	35
3,900	150,000	143,500	645,621,149	140,000	782,173,960	150,000	937,689,159			36
0,700	132,390		830,862,000	118,678	784,402,000	120,270	801,444,000	112,343	744,186,000	37
3,600	127,300	120,300	584,714,544	120,806	488,156,281	73,200	365,170,871	71,000	339,117,030	38
3,300	92,553		390,533,000		250,542,000	34,000	122,937,000			39
8,800		128,500	549,922,100	(*o*) 120,900	495,663,700	121,300	476,272,500	(*o*) 105,500	421,155,600	40
6,250			445,804,848		354,047,654	(*o*) 69,870	286,218,156	(*o*) 68,270	287,165,218	41
4,800		95,100	440,886,606	(*n*) 88,200	409,680,096	(*n*) 82,300	377,662,174	(*n*) 79,440	304,400,743	42
8,200	82,600		436,633,000	75,000	362,094,000	56,000	263,299,360	39,250	199,847,650	43
6,000	67,494		381,404,000		241,723,000					44
1,300	110,500	108,000	413,992,663	101,000	383,128,587	91,500	350,024,224	84,000	318,700,406	45
9,750	129,000	124,500	655,035,700	127,000	634,248,100	120,000	631,681,400	115,000	513,962,900	46
1,900		105,000	491,171,956							47
1,400	91,560		454,600,000	90,110	390,808,000	91,490	318,395,010	(*o*) 58,390	180,932,804	48
9,000			567,869,411		399,543,412	54,942	207,140,920	45,000	156,979,298	49
6,800			441,845,615		374,724,290	67,040	293,010,721	67,180	251,310,788	50
9,800		111,800	559,090,541	(*o*) 98,700	495,593,161	(*o*) 107,400	535,078,389	106,100	522,063,648	51
8,700		100,020	458,973,651	(*o*) 81,400	382,228,176	77,400	350,695,351	(*k*) 81,500	350,518,281	52
3,800	72,080		506,009,000	70,245	352,253,000	47,990	266,320,000	38,555	198,959,000	53
7,500			285,767,900		234,238,160		222,310,255	56,250	217,377,479	54
3,400		84,205	383,337,429	74,100	305,326,889	80,070	334,518,201	74,800	262,971,086	55
0,500	92,620		374,563,000	84,200	355,707,000	76,300	339,468,000	57,830	264,399,000	56
6,400										57
0,900	53,200	53,200	240,169,182	(*o*) 48,600	220,727,440	(*o*) 43,800	183,268,485	(*q*) 628,410	174,943,577	58
8,600										59
3,100										60
4,700	81,500	81,500	269,681,600	74,000	247,191,413	68,200	213,459,806	58,300	184,683,171	61
8,500	60,000	54,800	148,932,217							62
3,200		52,094	302,031,809	(*n*) 44,990	271,440,543	(*n*) 44,750	227,490,211	32,796	170,852,661	63
										64
3,800	80,696		416,134,000	77,950	401,856,000	86,410	399,825,337	75,484	364,574,445	65
1,500		52,500	242,563,000	(*n*, *G*) 51,300	220,324,000	67,000	192,253,000	56,400	190,355,000	66
4,900	84,900	75,290	376,764,523	80,150	352,809,582	77,680	326,148,706	72,070	296,678,980	67
4,700	45,200	45,150	171,315,819	(See the N. Y. Edison & Allied Cos.)		32,980	126,197,021	30,000	104,207,062	68
1,600	76,800	75,000	307,909,700	75,000	277,591,025	64,800	232,848,275	59,600	218,245,950	69
9,500	130,000	120,600	222,096,800	125,540	565,609,500	106,400	439,380,300			70
0,300	47,000		219,813,000	41,900	201,094,000	38,800	187,052,800	30,500	177,233,500	71
4,400	76,600	76,600	356,228,046	(*n*) 63,500	328,712,384					72
1,900		66,300	339,189,800	(*n*) 72,600	301,548,168	(*n*) 74,600	278,626,089	65,000	247,311,779	73
9,500	68,000		338,629,000	66,500	319,842,000	66,000	222,927,000	65,000	252,735,540	74
										75
6,400	67,797		298,387,145	(*o*) 63,980	285,892,553	67,080	268,618,910	58,645	244,055,341	76
										77
3,000	82,400	82,400	528,895,495							78
5,500			259,164,000		183,843,000	43,500	151,908,790			79
1,500	55,200		275,550,594	53,275	206,356,017	24,750	113,107,669			80
2,700	53,100		286,820,000	48,100	255,766,000	44,400	237,403,000	39,300	196,911,791	81
3,900			283,520,629	(*N*)	275,376,599	62,000	258,765,399			82
						31,000	115,525,700			83
93,100	476,000,000	54,300		105,100	494,805,962	30,400				
69,200	295,981,170	33,790		53,045	270,606,693	30,900		53,200	53,200	240,169,182	(*o*) 48,600
90,200	374,034,000	42,700	112,000	101,000	338,215,600	38,600				
	444,904,828	50,800			377,746,958	43,100				

	63,160	292,324,270	33,400	53,370		276,816,917		31,400	46,315		188,665,617		21,5	
54,440	(o)	50,400	287,290,707	32,800		54,160	278,947,541		31,800		56,000	286,529,056		32,7
61,380		61,480	284,597,748	32,500	68,000	67,600	292,252,317		33,300	61,000	60,784	296,527,833		33,9

57	Western Massachusetts Companies System	57		86,100		85,100	443,000,000		50,500		93,100			
58	Central Maine Power Company System	58	(o)	88,070			440,667,827		50,300					
59	Montaup Electric Company	59		89,800		77,940	435,364,000		49,700		96,000			
60	N. Y. State Elec. & Gas Corp. Group (Assoc. G. & E. System)	60	(o)	89,500	(o)	33,500	430,009,374		49,100					
61	Los Angeles Gas & Electric Corporation	61		115,900		115,900	429,006,384		48,970		115,000			
62	Assoc. Gas & Elec. System (South Carolina Group)* (*h*)	62	(o)	123,900	(o)	123,900	425,907,556		48,600		68,000			
63	Northern Indiana Public Service Company	63		76,650			423,230,408		48,300					
64	Assoc. Gas & Elec. System (West. Penna. Group)* (*i*)	64	(o)	84,300	(o)	84,000	411,565,334		46,900					
65	Minnesota Power & Light Company	65	(o)	86,870	(o)	86,870	391,586,638		44,700					
66	Hartford Electric Light Company	66	(o)	80,000	(o)	83,000	368,970,842		42,200					
67	Rochester Gas & Elec. Corp. Group (Assoc. G. & E. System)	67	(o)	72,727	(o)	71,227	366,281,440		41,800		86,926			
68	Westchester Lighting Company	68		58,328		0	357,430,320		40,800		56,580			
69	City of Seattle, Dept. of Lighting	69		90,000		90,000	353,764,500		40,400		89,500			
70	U. S. Government (Muscle Shoals)	70		161,634	(t)	162,034	345,603,400		39,400		148,000			
71	Nebraska Power Company	71	(o)	70,600	(o)	70,600	345,568,500		39,400		68,000			
72	Indianapolis Power & Light Company	72		76,500		61,900	344,025,888		39,300					
73	Central Illinois Public Service Company	73		83,000			342,162,436		39,100					
74	New Orleans Public Service Inc.	74		74,000		74,000	341,034,400		38,900		71,500			
75	Public Service Company of Indiana*	75		72,588		40,775	320,594,122		36,600					
76	Public Service Company of Colorado	76	(o)	71,783	(o)	71,783	318,427,572		36,350					
77	The Yonkers Electric Light & Power Company	77	(h)	17,271		0	317,666,263		36,300		(See the N			
78	Hetch Hetchy Water Supply, City & County of San Francisco	78		83,600		83,600	309,450,010		35,300					
79	Arkansas Power & Light Company	79		62,500		28,300	304,690,000		34,800		67,000			
80	Salt River Valley Water Users' Association	80				63,160	292,324,270		33,400		53,370			
81	Northwestern Electric Company	81	(o)	54,440	(o)	50,400	287,290,707		32,800					
82	Wisconsin Power & Light Company	82		66,380		61,480	284,597,748		32,500		68,000			
83	The United Illuminating Company (*M*)	83					278,062,000		31,800		36,500			
84	The Nevada-California Electric Corporation System (*B*)	84		48,900		41,800	275,500,157		31,450					
85	Illinois Electric Power Company	85		49,500			272,384,736		31,100		51,600			
86	The Columbus Railway, Power & Light Company	86	(o)	61,000	(o)	61,000	270,864,584		30,900					
87	Gulf States Utilities Company	87		47,810		36,000	266,182,789		30,400		54,567			
88	The Scranton Electric Company	88		51,400		51,400	263,811,192		30,100		55,500			
89	City of Tacoma, Dept. Public Utilities, Light Division	89		55,000		66,000	253,913,000		29,000		55,000			
90	Birmingham Electric Company	90		48,363		0	252,222,842		28,800		52,820			
91	Kansas Gas & Electric Company	91		50,600		50,600	251,304,100		28,700		54,500			
92	Kentucky Utilities Company	92		56,000		50,500	249,540,548		28,500		68,570			
93	Central Power & Light Company	93		48,025		43,125	249,425,222		28,500		55,270			
94	Long Island Lighting Company System	94		70,500		70,500	244,156,063		27,850		65,300			
95	Penn Central Light & Power Company	95				47,500	234,162,059		26,700		50,300			
96	Pacific Power & Light Company	96		41,250		18,325	230,487,553		26,300					
97	Central Hudson Gas & Electric Corporation	97		53,500			221,840,852		25,300		53,000			
98	Virginia Public Service Company	98		53,115		55,680	220,893,275		25,200		47,500			
99	Dallas Power & Light Company	99	(o)	52,300	(o)	52,000	220,291,750		25,100		56,000			
100	City of Detroit, Public Lighting Commission	100				45,000	217,010,380		24,750		47,000			
101	Atlantic City Electric Company	101		52,900		52,900	213,819,894		24,400		50,000			
102	Florida Power & Light Company	102		65,260		64,880	208,124,600		23,750					
103	West Texas Utilities Company	103		42,915			203,968,162		23,300					
104	Public Service Company of Oklahoma	104		42,500		37,000	200,698,570		22,900		54,200			
105	San Antonio Public Service Company	105		41,700		36,500	199,783,901		22,800		54,500			
106	San Diego Consolidated Gas & Electric Company	106		48,300		48,300	198,800,090		22,650		47,200			
107	Southwestern Gas & Electric Company	107				30,300	196,644,219		22,400					
108	Jersey Central Power & Light Company	108		58,000		54,000	192,586,692		22,000		42,500			
109	Blackstone Valley Gas & Electric Company	109	(o)	46,187	(o)	6,000	192,089,421		21,950					
110	New Bedford Gas & Edison Light Company	110	(o)	51,200	(o)	51,200	190,585,830		21,700		54,100			
111	Memphis Power & Light Company	111	(o)	44,700	(o)	44,700	189,341,440		21,600		49,000			
112	Wisconsin Public Service Corporation and Subsidiary	112	(o)	44,600			185,877,236		21,200					
113	Des Moines Electric Light Company	113		42,000		42,000	185,041,631		21,100					
114	Public Service Company of New Hampshire	114	(o)	43,700	(o)	42,675	181,949,548		20,750		40,000			
115	City of Cleveland, Dept. of Public Utilities	115		37,000		37,000	179,870,560		20,500					
116	Empire District Electric Company	116	(o)	37,100	(o)	37,100	178,540,162		20,380					
117	Pennsylvania Power Company	117		39,000		0	178,076,358		20,300					
118	Sioux City Gas & Electric Co., Iowa Pub. Serv. Co. System	118		39,311			171,071,489		19,530					
119	Indiana Service Corporation	119		35,739		21,000	157,710,391		18,000					
120	Central Illinois Light Company	120		35,000		0	151,421,136		17,300		38,200			
121	Cumberland County Power & Light Company	121		39,815		18,815	149,093,897		17,020		43,600			
122	Indiana General Service Company	122		29,640		2,840	147,896,790		16,880		31,390			
123	Mississippi Power & Light Company	123		32,074			146,433,090		16,700					
124	Tampa Electric Company	124		27,840		24,600	143,522,953		16,380		35,630			
125	Kansas Power & Light Company	125		29,650			143,502,741		16,380					
126	Interstate Power Company (Del.) and Subsidiaries	126		40,403		33,480	141,315,424		16,130					
127	Delaware Power & Light Company	127		28,119		0	136,633,985		15,600		28,700			
128	Iowa Railway & Light Corporation	128		32,000		32,000	134,821,422		15,390					
129	The Connecticut Power Company	129		43,452		11,140	132,960,016		15,180					
130	South Carolina Power Company	130		31,200			130,897,921		14,940					
131	Moline-Rock Island Manufacturing Company	131		33,590		29,000	130,452,095		14,900		41,380			
132	Staten Island Edison Corporation	132	(o)	31,700	(o)	31,700	128,454,330		14,660		36,000			
133	United Power & Light Corporation (of Kansas)	133		26,000			127,308,532		14,530					
134	Mountain States Power Company	134					127,099,816		14,500					
135	Wisconsin Valley Electric Company	135		31,360		13,920	126,791,351		14,470		29,800			
136	Luzerne County Gas & Electric Corporation	136	(o)	25,130	(o)	41,750	123,216,441		14,080		41,000			
137	Mississippi Power Company	137		26,783			118,526,461		13,530					
138	Tennessee Public Service Company	138		22,387		77	112,918,808		12,900		23,500			
139	El Paso Electric Company (and Affiliates)	139		24,034		24,034	110,485,989		12,600		25,125			
140	Florida Power Corporation and Subsidiaries	140		25,800		25,800	109,489,363		12,500		25,300			
141	Bangor Hydro Electric Company	141	(o)	23,830	(o)	23,830	106,550,576		12,160					
142	Wheeling Electric Company	142		26,980		0	100,652,334		11,500					
	Total (*C*)						94,829,349,592							
	Canada													
143	Hydro-Electric Power Commission of Ontario	1		915,945		699,630	4,387,316,157		500,800		943,710			
144	The Shawinigan Water & Power Company	2		540,500			3,436,436,460		392,300		545,600			
145	Canadian Hydro-Electric Corporation, Ltd. System	3		485,775		485,075	2,414,375,792		275,600		451,700			
146	Montreal Light, Heat & Power Consolidated	4		285,150		142,700	1,557,929,949		177,800		312,075			
147	Duke-Price Power Company, Ltd.	5		307,000		307,000	1,518,632,376		173,400		341,000			
148	Winnipeg Electric Company (*J*)	6		132,700		132,700	614,665,600		70,200		121,500			
149	West Kootenay Power & Light Company, Ltd.	7		83,500		83,500	591,772,849		67,500					
150	Canadian Niagara Power Company, Ltd.	8				74,500	490,148,000		55,950					
151	British Columbia Electric Railway Company, Ltd. (*D*)	9	(o)	100,800	(o)	100,800	425,510,139		48,500		104,000			
152	Canada Northern Power Corporation, Ltd. System	10		57,270		57,270	418,226,810		47,700		51,680			
153	City of Winnipeg Hydro-Electric System	11		89,100		85,845	412,080,147		47,000		89,223			
154	Calgary Power Company, Ltd.	12		45,300		35,600	188,668,281		21,500					
155	The Nova Scotia Power Commission	13					173,924,966		19,850					
156	Southern Canada Power Company, Ltd.	14		41,000		41,000	159,873,880		18,250		40,800			
157	Montreal Island Power Company	15		44,250		44,250	146,048,890		16,670		41,225			
	Total						16,935,610,296							
	Mexico													
158	The Mexican Light & Power Company, Ltd.		(o)	122,907	(o)	122,907	691,150,190		78,900					
	Cia. Agricola y de Fuerza Electrica del Rio Conchos, S. A.					1931 Data	not available							19
	The Guanajuato Power & Electric Company					1931 Data	not available							19
	Puebla Tramway, Light & Power Company					1931 Data	not available							19
	Electric Railways and Electrified Railroads													
159	Interborough Rapid Transit Company	1		301,830		301,830	1,198,884,267		136,900					
160	Williamsburgh Power Plant Corporation (B. M. T.)	2	(o)	162,600	(o)	162,600	642,157,665		73,300					
161	Chicago Surface Lines	3					595,733,093		68,000					
162	Philadelphia Rapid Transit Company	4		102,227		0	333,822,958		38,100					
163	The Pennsylvania Railroad (Long Island City Gen. Station)	5	(o)	105,430		95,600	330,309,340		37,700		115,000			
164	Boston Elevated Railway	6		98,490		98,490	257,065,945		29,350		108,108			
165	The New York Central Railroad Company	7		86,300		73,000	250,573,893		28,600		85,400			
166	The New York, New Haven & Hartford Railroad Company	8	(o)	42,800	(o)	28,900	213,400,000		24,300					
167	St. Louis Public Service Company	9		51,287		16,121	159,433,615		18,200		58,780			
168	Pacific Electric Railway Company	10		48,000		0	157,888,334		18,000		51,000			

105,														
86,100	83,100	443,000,000	50,500	93,100	93,100	476,000,000		54,300		105,100	494,805,982		56,400	

32,700	53,100	.....	286,820,000	48,100	255,766,000	44,400	237,403,000	39,300	196,911,791	81		
33,900	.....	.....	283,520,629	(N)	275,376,599	62,000	258,765,399	.....	.....	82		
.....	.....	.....	.....	.....	.....	31,000	115,535,700	.....	.....	83		
93,100	476,000,000	54,300	.....	105,100	494,805,982	36,400	.....	.....	.....	.....	.....	
69,200	295,981,170	33,790	.....	53,045	270,606,693	30,900	53,200	53,200	240,169,182	(o)	48,600	
90,200	374,034,000	42,700	112,000	101,000	338,215,600	38,600	.....	.....	.....	.....	.....	
.....	444,904,828	50,800	.....	.....	377,746,958	43,100	.....	.....	.....	.....	.....	
115,000	388,312,942	44,300	90,000	90,000	304,100,629	34,700	81,500	81,500	269,681,600		74,000	
65,100	178,976,937	20,400	55,000	53,200	162,129,679	18,500	60,000	54,800	148,932,217	.....	.....	
68,740	370,866,979	42,300	.....	66,928	334,913,629	38,200	.....	52,094	302,031,809	(n)	44,990	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
95,825	456,913,135	52,150	.....	87,736	427,848,189	48,800	80,696	.....	416,134,000		77,950	
59,800	396,238,000	45,200	.....	55,900	362,855,320	41,500	.....	52,500	242,563,000	(n, G)	51,300	
78,008	387,454,655	44,200	91,523	83,023	393,506,327	44,900	84,900	75,290	376,764,523		80,150	
56,482	283,625,262	32,300	50,600	50,200	216,503,601	24,700	45,200	45,150	171,315,819	(See the N. Y. Edi		
89,000	384,812,680	43,480	90,000	80,000	364,959,930	41,600	76,800	75,000	307,909,700		75,000	
145,092	306,119,200	34,900	116,260	112,500	171,681,600	19,500	130,000	120,600	222,096,800		125,540	
65,000	320,411,600	36,500	.....	55,000	265,901,500	30,300	47,000	.....	219,813,000		41,900	
78,600	374,997,370	42,800	.....	82,800	388,871,320	44,400	76,600	76,600	356,228,046	(n)	63,500	
87,500	366,474,373	41,800	.....	86,300	367,912,947	41,900	.....	66,300	339,189,800	(n)	72,600	
70,100	350,484,000	40,000	.....	68,000	345,847,000	39,500	68,000	.....	338,629,000		66,500	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
73,682	331,467,254	37,800	.....	72,453	319,607,394	36,400	67,797	.....	298,387,145	(o)	63,980	
the N. Y. Edison & Allied Cos.)												
83,600	493,888,420	56,250	83,400	83,400	464,339,110	53,000	82,400	82,400	528,895,495	.....	.....	
66,100	331,538,000	37,800	.....	.....	310,955,000	35,500	.....	.....	259,164,000	.....	.....	
.....	276,816,917	31,400	46,315	.....	188,665,617	21,500	55,200	.....	275,550,594		53,275	
54,160	278,947,541	31,800	.....	56,000	286,529,056	32,700	53,100	.....	286,820,000		48,100	
67,600	292,252,317	33,300	61,000	60,784	296,527,833	33,900	.....	.....	283,520,629		(N)	
.....	283,365,700	32,300	76,500	.....	288,417,200	32,900	34,500	.....	275,965,650	.....	.....	
51,400	292,135,954	33,300	.....	55,800	300,320,585	34,200	.....	51,900	294,781,380		57,600	
50,000	268,900,823	30,700	56,650	55,000	246,321,037	28,000	54,190	53,000	228,660,184		53,010	
71,000	294,445,800	33,600	70,000	70,000	315,558,310	36,000	63,000	60,000	283,654,155	(n)	55,100	
52,000	293,365,397	33,500	48,998	47,000	273,182,834	31,100	42,380	35,204	191,081,273		29,754	
.....	279,155,000	31,860	58,200	.....	240,508,000	27,400	52,400	.....	245,526,000		51,000	
53,000	254,074,415	29,000	55,000	54,300	255,771,531	29,200	49,000	49,000	208,399,465		61,500	
52,464	277,437,821	31,700	.....	54,820	292,759,162	33,400	53,720	.....	298,379,513		53,811	
52,500	271,396,600	30,980	.....	62,400	284,354,000	32,500	49,900	.....	249,717,000		44,600	
68,570	252,292,869	28,800	(e) 60,000	.....	240,724,354	27,500	.....	39,910	194,822,819		45,800	
55,270	276,668,160	31,500	42,800	.....	239,756,655	27,300	.....	34,845	146,744,975	(n)	25,205	
64,900	222,301,296	25,375	58,200	48,000	197,097,106	22,500	54,935	50,000	172,923,000		49,000	
50,100	243,323,574	27,700	51,550	50,300	237,817,248	27,200	45,950	45,800	213,808,418	(n)	45,000	
42,775	220,440,374	25,100	.....	.....	251,759,000	28,700	.....	.....	232,877,000		35,105	
50,000	195,689,541	22,300	56,500	55,400	200,566,867	22,900	55,000	53,000	213,612,676	(o)	52,900	
44,400	193,392,263	22,100	.....	.....	.....	.....	.....	.....	.....	.....	.....	
53,000	215,889,590	24,600	.....	55,400	199,099,200	22,700	46,400	.....	179,165,000		44,300	
44,700	206,514,320	23,500	47,000	44,000	190,900,800	21,800	.....	.....	.....	.....	.....	
.....	201,758,000	22,900	48,000	.....	184,172,000	21,000	41,500	.....	148,331,000		36,000	
67,940	207,310,965	23,600	.....	59,208	202,110,030	23,000	60,708	.....	199,322,000		65,364	
41,140	231,817,948	26,400	41,000	39,000	246,515,315	28,200	.....	44,220	147,963,154	.....	.....	
52,800	268,724,289	30,700	47,000	.....	255,220,126	29,100	.....	46,000	224,426,315		39,222	
.....	238,979,012	27,280	53,400	51,600	238,200,935	27,200	.....	.....	.....	.....	.....	
47,000	179,709,699	20,500	45,300	.....	185,639,011	21,200	.....	.....	153,825,600	.....	.....	
.....	163,474,091	18,650	.....	.....	149,696,794	17,000	.....	31,790	119,647,273	.....	.....	
40,000	144,902,031	16,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	
49,815	183,442,323	20,900	.....	55,515	207,701,144	23,700	.....	54,970	182,918,142	(o)	52,200	
53,000	195,293,900	22,300	58,800	58,000	219,020,744	25,000	58,800	56,000	167,613,529		50,500	
48,000	195,429,828	22,300	.....	45,000	182,112,000	20,800	41,261	.....	172,781,000		46,000	
48,300	205,587,325	23,400	50,400	.....	176,194,115	20,100	.....	.....	149,811,913	.....	.....	
42,500	183,658,907	20,950	.....	42,500	172,539,101	19,700	.....	36,000	159,666,072		40,000	
39,700	157,222,444	17,900	.....	.....	.....	.....	.....	.....	.....	.....	.....	
38,000	189,781,760	21,650	38,300	.....	198,179,340	22,600	37,200	.....	186,242,950		33,700	
49,600	224,158,905	25,600	.....	60,600	258,682,003	29,500	55,500	.....	226,034,240	(o)	61,000	
45,000	232,425,592	26,490	.....	.....	.....	.....	.....	.....	.....	.....	.....	
42,500	175,304,555	19,950	42,400	40,500	162,477,080	18,500	.....	.....	.....	.....	.....	
37,400	178,538,313	20,380	41,000	.....	180,016,985	20,500	45,000	40,000	152,957,600		34,000	
37,500	171,834,023	19,600	40,900	39,400	177,338,443	20,200	(K)	(K)	156,467,174		31,727	
43,220	143,380,401	16,350	41,510	41,940	144,364,260	16,400	31,380	30,200	114,835,060	(n)	30,580	
.....	146,368,000	16,700	23,620	.....	145,405,000	16,600	26,480	.....	122,579,000		24,600	
31,000	138,781,877	15,840	.....	25,508	103,748,759	11,800	.....	.....	.....	.....	.....	
.....	178,992,370	20,400	.....	33,000	170,887,397	19,400	31,720	.....	152,885,453		25,340	
28,700	142,385,334	16,250	.....	27,800	122,992,015	14,000	.....	30,750	108,519,670	.....	.....	
.....	142,532,297	16,250	.....	.....	.....	.....	.....	.....	.....	.....	.....	
27,880	137,457,239	15,700	31,200	29,700	134,571,700	15,360	24,500	23,500	122,337,055	(o)	25,000	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
24,755	139,618,715	15,940	.....	.....	.....	.....	.....	.....	.....	.....	.....	
26,900	121,419,692	13,860	.....	29,440	136,213,088	15,500	.....	.....	.....	.....	.....	
40,000	157,500,686	17,990	40,480	40,000	164,206,522	18,700	35,030	34,750	151,902,906		31,570	
31,500	142,486,580	16,250	37,000	31,800	128,665,860	14,650	32,600	28,100	117,999,180		29,000	
27,150	127,822,014	14,590	.....	23,230	103,802,181	11,850	.....	.....	.....	.....	.....	
.....	123,611,405	14,100	.....	.....	112,617,618	12,860	.....	.....	.....	.....	.....	
25,000	118,703,271	13,550	.....	.....	.....	.....	.....	.....	.....	.....	.....	
40,000	129,087,117	14,700	29,610	26,810	115,530,335	13,200	.....	.....	.....	.....	.....	
27,912	115,634,958	13,200	.....	30,300	116,745,731	13,300	.....	23,400	93,469,303	(n)	19,000	
23,144	114,480,898	13,070	.....	23,065	111,870,280	12,700	.....	.....	.....	.....	.....	
24,000	112,612,701	12,850	.....	.....	.....	.....	.....	.....	.....	.....	.....	
.....	103,891,909	11,850	.....	.....	.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
.....	113,823,000	13,000	.....	.....	119,716,000	13,660	.....	.....	104,830,000	.....	.....	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
937,320	5,077,430,835	580,000	857,950	847,710	5,071,853,732	580,000	802,245	794,430	4,429,404,096		746,275	
.....	3,226,014,549	368,000	(g) 538,300	.....	3,726,436,341	426,000	532,945	532,945	3,409,717,522		420,300	
450,000	2,525,560,158	288,000	395,000	387,000	2,090,788,460	239,000	286,000	280,000	1,297,239,606	.....	.....	
310,000	1,650,636,536	188,300	292,020	.....	1,568,864,226	179,000	279,250	.....	1,450,484,998		256,760	
341,000	2,012,869,376	229,000	351,000	351,000	2,093,829,000	239,200	321,000	315,000	2,096,903,000	.....	.....	
119,750	598,508,500	68,400	125,400	124,200	703,982,200	80,350	130,500	129,000	654,491,510		112,000	
83,700	599,257,403	68,400	.....	74,800	539,626,687	61,500	.....	39,700	516,071,474	(n)	65,600	
.....	614,411,500	70,100	.....	.....	632,261,900	72,200	.....	.....	621,423,800	.....	.....	
100,200	437,731,126	50,000	98,900	94,000	418,075,320	47,700	98,200	94,600	390,564,500		87,400	
50,000	367,130,780	41,900	46,420	46,000	347,797,680	39,600	47,510	45,000	343,930,010		43,690	
.....	414,195,787	47,300	73,400	.....	445,579,835	50,900	76,290	74,940	400,668,600		75,834	
44,860	139,302,262	15,900	29,500	.....	126,876,336	14,500	26,100	.....	104,577,805	.....	.....	
.....	151,414,019	17,850	.....	.....	.....	.....	.....	.....	.....	.....	.....	
.....	170,619,052	19,480	31,000	31,000	149,105,920	17,000	31,700	.....	146,233,060	(n)	26,300	
41,000	105,805,180	12,070	.....	.....	.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
121,485	681,822,792	77,800	.....	111,140	641,828,127	73,200	107,608	.....	628,832,675	(o)	102,386	
..1930 Data	not available...	.....	.....	22,000	141,967,487	16,200	24,500	23,600	160,099,800	(o)	22,700	
..1930 Data	not available...	.....	.....	18,134	107,111,000	12,200	.....	.....	100,430,000	.....	.....	
..1930 Data	not available...	.....	21,590	.....	104,808,000	11,900	.....	.....	.....	.....	.....	
303,400	1,228,301,211	140,000	.....	304,460	1,217,047,463	138,900	.....	298,760	1,177,155,819	(n)	284,660	
170,000	618,219,724	70,600	(o) 154,100	159,000	599,442,974	68,400	(o) 146,300	150,000	568,889,703	(o)	138,200	
197,574	624,776,062	71,200	.....	200,698	(p) 664,908,358	75,900	.....	195,730	(r) 592,545,223		300,660	(r)
111,750	366,341,403	41,800	.....	116,162	384,076,148	43,800	.....	110,071	377,326,475	(n)	120,318	
86,800	343,354,637	39,200	104,000	89,800	343,646,828	39,200	99,600	87,700	333,037,210		99,600	
103,194	(F) 270,054,975	30,800	95,755	91,403	247,473,090	28,200	(s) 95,937	(s) 91,576	(s) 252,965,140	(s)	94,457	(s)
71,600	251,780,404	28,600	86,500	75,400	247,599,220	28,200	80,000	68,280	230,003,185		75,000	
43,000	225,941,425	25,800	.....	41,600	209,370,023	23,900	.....	40,750	201,191,225		50,500	
57,395	170,343,455	19,450	.....	.....	.....	.....	.....	.....	.....	.....	.....	
48,000	169,134,719	19,300	55,000	48,000	182,813,761	20,850	55,000	48,000	184,759,206		54,000	
6,400	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
0,900	53,200	53,200	240,169,182	(o) 48,600	220,727,440	(o) 43,800	183,268,485	(q) 628,410	174,943,577	58		

164	Boston Elevated Railway	6		98,490		98,490	257,065,945		29,350		108,108			
165	The New York Central Railroad Company	7		86,300		73,000	250,573,893		28,600		85,400			
166	The New York, New Haven & Hartford Railroad Company	8	(o)	42,800	(o)	28,900	213,400,000		24,300					
167	St. Louis Public Service Company	9		51,287		16,121	159,433,615		18,200		58,780			
168	Pacific Electric Railway Company	10		48,000		0	157,888,334		18,000		51,000			
105.														
86,100	83,100	445,000,000	50,500	93,100	93,100	476,000,000		54,300		105,100	494,805,982		56,4	
88,070		440,667,827	50,300		69,200	295,981,170		33,790		53,045	270,606,693		30,9	
89,800	77,940	435,364,000	49,700	96,000	90,200	374,034,000		42,700	112,000	101,000	338,215,600		38,6	
89,500	(o) 33,500	430,009,374	49,100			444,904,828		50,800			377,746,958		43,1	
115,900	115,900	429,006,384	48,970	115,000	115,000	388,312,942		44,300	90,000	90,000	304,100,629		34,7	
123,900	(o) 123,900	425,907,556	48,600	68,000	65,100	178,976,937		20,400	55,000	53,200	162,129,679		18,5	
76,650		423,230,408	48,300		68,740	370,866,979		42,300		66,928	334,913,629		38,2	
84,300	(o) 84,000	411,565,334	46,900											
86,870	(o) 86,870	391,586,638	44,700		95,823	456,913,135		52,150		87,736	427,848,189		48,8	
80,000	(o) 83,000	368,970,842	42,200		59,800	396,238,000		45,200		55,900	362,855,320		41,5	
72,727	(o) 71,227	366,281,440	41,800	86,926	78,008	387,454,655		44,200	91,523	83,023	393,506,327		44,9	
58,328	0	357,430,320	40,800	56,580	56,482	283,625,262		32,300	50,600	50,200	216,503,601		24,7	
90,000	90,000	353,764,500	40,400	89,500	89,000	384,812,680		43,480	90,000	80,000	364,959,930		41,6	
161,634	(t) 162,034	345,603,400	39,400	148,000	145,092	306,119,200		34,900	116,260	112,500	171,681,600		19,5	
70,600	(o) 70,600	345,568,500	39,400	68,000	65,000	320,411,600		36,500		55,000	265,901,500		30,3	
76,500	61,900	344,025,888	39,300		78,600	374,997,370		42,800		82,800	388,871,320		44,4	
83,000		342,162,436	39,100		87,500	366,474,373		41,800		86,300	367,912,947		41,9	
74,000	74,000	341,034,400	38,900	71,500	70,100	350,484,000		40,000		68,000	345,847,000		39,5	
72,588	40,775	320,594,122	36,600											
71,783	(o) 71,783	318,427,572	36,350		73,682	331,467,254		37,800		72,453	319,607,394		36,4	
17,271	0	317,666,263	36,300	(See the N. Y. Edison & Allied Cos.)										
83,600	83,600	309,450,010	35,300		83,600	493,888,420		56,250	83,400	83,400	464,339,110		53,0	
62,500	28,300	304,690,000	34,800	67,000	66,100	331,538,000		37,800			310,955,000		35,5	
	63,160	292,324,270	33,400	53,370		276,816,917		31,400	46,315		188,665,617		21,5	
54,440	(o) 50,400	287,290,707	32,800		54,160	278,947,541		31,800		56,000	286,529,056		32,7	
66,380	61,480	284,597,748	32,500	68,000	67,600	292,252,317		33,300	61,000	60,784	296,527,833		33,9	
		278,062,000	31,800	36,500		283,365,700		32,300	76,500		288,417,200		32,9	
48,900	41,800	275,500,157	31,450		51,400	292,135,954		33,300		55,800	300,320,585		34,2	
49,500		272,384,736	31,100	51,600	50,000	268,900,823		30,700	56,650	55,000	246,321,037		28,0	
61,000	(o) 61,000	270,864,584	30,900		71,000	294,445,800		33,600	70,000	70,000	315,558,310		36,0	
47,810	36,000	266,182,789	30,400	54,567	52,000	293,365,397		33,500	48,998	47,000	273,182,834		31,1	
51,400	51,400	263,811,192	30,100	55,500		279,155,000		31,860	58,200		240,508,000		27,4	
55,000	66,000	253,913,000	29,000	55,000	53,000	254,074,415		29,000	55,000	54,300	255,771,531		29,2	
48,363	0	252,222,842	28,800	52,820	52,464	277,437,821		31,700		54,820	292,759,162		33,4	
50,600	50,600	251,304,100	28,700	54,500	52,500	271,396,600		30,980		62,400	284,354,000		32,5	
56,000	50,500	249,540,548	28,500	68,570	68,570	252,292,869		28,800	(e) 60,000		240,724,354		27,5	
48,025	43,125	249,425,222	28,500	55,270	55,270	276,668,160		31,500	42,800		239,756,655		27,3	
70,500	70,500	244,156,063	27,850	65,300	64,900	222,301,296		25,375	58,200	48,000	197,097,106		22,5	
	47,500	234,162,059	26,700	50,300	50,100	243,323,574		27,700	51,550	50,300	237,817,248		27,2	
41,250	18,325	230,487,553	26,300		42,775	220,440,374		25,100			251,759,000		28,7	
53,500		221,840,852	25,300	53,000	50,000	195,689,541		22,300	56,500	55,400	200,566,867		22,9	
53,115	55,680	220,893,275	25,200	47,500	44,400	193,392,263		22,100						
52,300	(o) 52,000	220,291,750	25,100	56,000	53,000	215,889,590		24,600		55,400	199,099,200		22,7	
	45,000	217,010,380	24,750	47,000	44,700	206,514,320		23,500	47,000	44,000	190,900,800		21,8	
52,900	52,900	213,819,894	24,400	50,000		201,758,000		22,900	48,000		184,172,000		21,0	
65,260	64,880	208,124,600	23,750		67,940	207,310,965		23,600		59,208	202,110,030		23,0	
42,915		203,968,162	23,300		41,140	231,817,948		26,400	41,000	39,000	246,515,315		28,2	
42,500	37,000	200,698,570	22,900	54,200	52,800	268,724,289		30,700	47,000		255,220,126		29,1	
41,700	36,500	199,783,901	22,800	54,500		238,979,012		27,280	53,400	51,600	238,200,935		27,2	
48,300	48,300	198,800,090	22,650	47,200	47,000	179,709,699		20,500	45,300		185,639,011		21,2	
	30,300	196,644,219	22,400			163,474,091		18,650			149,696,794		17,0	
58,000	54,000	192,586,692	22,000	42,500	40,000	144,902,031		16,500						
46,187	(o) 6,000	192,089,421	21,950		49,815	183,442,323		20,900		55,515	207,701,144		23,7	
51,200	(o) 51,200	190,585,830	21,700	54,100	53,000	195,293,900		22,300	58,800	58,000	219,020,744		25,0	
44,700	(o) 44,700	189,341,440	21,600	49,000	48,000	195,429,828		22,300		45,000	182,112,000		20,8	
44,600		185,877,236	21,200		48,300	205,587,325		23,400	50,400		176,194,115		20,1	
42,000	42,000	185,041,631	21,100		42,500	183,658,907		20,950		42,500	172,539,101		19,7	
43,700	(o) 42,675	181,949,548	20,750	40,000	39,700	157,222,444		17,900						
37,000	37,000	179,870,560	20,500		38,000	189,781,760		21,650	38,300		198,179,340		22,6	
37,100	(o) 37,100	178,540,162	20,380		49,600	224,158,905		25,600		60,600	258,682,003		29,5	
39,000	0	178,076,358	20,300		45,000	232,425,592		26,490						
39,311		171,071,489	19,530		42,500	175,304,555		19,950	42,400	40,500	162,477,080		18,5	
35,739	21,000	157,710,391	18,000		37,400	178,538,313		20,380	41,000		180,016,985		20,5	
35,000	0	151,421,136	17,300	38,200	37,500	171,834,023		19,600	40,900	39,400	177,338,443		20,2	
39,815	18,815	149,093,897	17,020	43,600	43,220	143,380,401		16,350	41,510	41,940	144,364,260		16,4	
29,640	2,840	147,896,790	16,880	31,390		146,368,000		16,700	23,620		145,405,000		16,6	
32,074		146,433,090	16,700		31,000	138,781,877		15,840		25,508	103,748,759		11,8	
27,840	24,600	143,522,953	16,380	35,630		178,992,370		20,400		33,000	170,887,397		19,4	
29,650		143,502,741	16,380		28,700	142,385,334		16,250		27,800	122,992,015		14,0	
40,403	33,480	141,315,424	16,130			142,532,297		16,250						
28,119	0	136,633,985	15,600	28,700	27,880	137,457,239		15,700	31,200	29,700	134,571,700		15,3	
32,000	32,000	134,821,422	15,390											
43,452	11,140	132,960,016	15,180		24,755	139,618,715		15,940						
31,200		130,897,921	14,940		26,900	121,419,692		13,860		29,440	136,213,088		15,5	
33,590	29,000	130,452,095	14,900	41,380	40,000	157,500,686		17,990	40,480	40,000	164,206,522		18,7	
31,700	(o) 31,700	128,454,330	14,660	36,000	31,500	142,486,580		16,250	37,000	31,800	128,665,860		14,6	
26,000		127,308,532	14,530		27,150	127,822,014		14,590		23,230	103,802,181		11,8	
		127,099,816	14,500			123,611,405		14,100			112,617,618		12,8	
31,360	13,920	126,791,351	14,470	29,800	25,000	118,703,271		13,550						
25,130	(o) 41,750	123,216,441	14,080	41,000	40,000	129,087,117		14,700	29,610	26,810	115,530,335		13,2	
26,783		118,526,461	13,530		27,912	115,634,958		13,200		30,300	116,745,731		13,3	
22,387	77	112,918,808	12,900	23,500	23,144	114,480,898		13,070		23,065	111,870,280		12,7	
24,034	24,034	110,485,989	12,600	25,125	24,000	112,612,701		12,850						
25,800	25,800	109,489,363	12,500	25,300		103,891,909		11,850						
23,830	(o) 23,830	106,550,576	12,160											
26,980	0	100,652,334	11,500			113,823,000		13,000			119,716,000		13,6	
		94,829,349,592												
915,945	699,630	4,387,316,157	500,800	943,710	937,320	5,077,430,835		580,000	857,950	847,710	5,071,853,732		580,0	
540,500		3,436,436,460	392,300	545,600		3,226,014,549		368,000	(g) 538,300		3,726,436,341		426,0	
485,775	485,075	2,414,375,792	275,600	451,700	450,000	2,525,560,158		288,000	395,000	387,000	2,090,788,460		239,0	
285,150	142,700	1,557,929,949	177,800	312,075	310,000	1,650,636,536		188,300	292,020		1,568,864,226		179,0	
307,000	307,000	1,518,632,376	173,400	341,000	341,000	2,012,869,376		229,000	351,000	351,000	2,093,829,000		239,2	
132,700	132,700	614,665,600	70,200	121,500	119,750	598,508,500		68,400	125,400	124,200	703,982,200		80,3	
83,500	83,500	591,772,849	67,500		83,700	599,257,403		68,400		74,800	539,626,687		61,5	
	74,500	490,148,000	55,950			614,411,500		70,100			632,261,900		72,2	
(o) 100,800	(o) 100,800	425,510,139	48,500	104,000	100,200	437,731,126		50,000	98,900	94,000	418,075,320		47,7	
57,270	57,270	418,226,810	47,700	51,680	50,000	367,130,780		41,900	46,420	46,000	347,797,680		39,6	
89,100	85,845	412,080,147	47,000	89,223		414,195,787		47,300	73,400		445,579,835		50,9	
45,300	35,600	188,668,281	21,500		44,860	139,302,262		15,900	29,500		126,876,336		14,5	
		173,924,966	19,850			151,414,019		17,850						
41,000	41,000	159,873,880	18,250	40,800		170,619,052		19,480	31,000	31,000	149,105,920		17,0	
44,250	44,250	146,048,890	16,670	41,225	41,000	105,805,180		12,070						
		16,935,610,296												
122,907	(o) 122,907	691,150,190	78,900		121,485	681,822,792		77,800		111,140	641,828,127		73,2	
	1931 Data	not available			1930 Data	not available				22,000	141,967,487		16,2	
	1931 Data	not available			1930 Data	not available				18,134	107,111,000		12,2	
	1931 Data	not available			1930 Data	not available			21,590		104,808,000		11,9	
301,830	301,830	1,198,884,267	136,900		303,400	1,228,301,211		140,000		304,460	1,217,047,463		138,9	
162,600	(o) 162,600	642,157,665	73,300		170,000	618,219,724		70,600	(o) 154,100	159,000	599,442,974		68,4	
		595,733,093	68,000		197,574	624,776,062		71,200		200,698	(p) 664,908,358		75,9	
102,227	0	333,822,958	38,100		111,750	366,341,403		41,800		116,162	384,076,148		43,8	
105,430	95,600	330,309,340	37,700	115,000	86,800	343,354,637		39,200	104,000	89,800	343,646,828		39,2	
98,490	98,490	257,065,945	29,350	108,108	103,194	(F) 270,054,975		30,800	95,755	91,403	247,473,090		28,2	
86,300	73,000	250,573,893	28,600	85,400	71,600	251,780,404		28,600	86,500	75,400	247,599,220		28,2	
42,800	(o) 28,900	213,400,000	24,300		43,000	225,941,425		25,800		41,600	209,370,023		23,9	
51,287	16,121	159,433,615	18,200	58,780	57,395	170,343,455		19,450						
48,000	0	157,888,334	18,000	51,000	48,000	169,134,719		19,300	55,000	48,000	182,813,761		20,8	

103,194	(F) 270,054,975		30,800		95,755		91,403	247,473,090		28,200	(s) 95,937	(s) 91,576	(s) 252,965,140	(s) 94,457	(s)			
71,600	251,780,404		28,600		86,500		75,400	247,599,220		28,200	80,000	68,280	230,003,185	75,000				
43,000	225,941,425		25,800		.....		41,600	209,370,023		23,900	.....	40,750	201,191,225	50,500				
57,395	170,343,455		19,450		.....		.....	.....		.....	.....	.....	.....	.....				
48,000	169,134,719		19,300		55,000		48,000	182,813,761		20,850	55,000	48,000	184,759,206	54,000				
56,400	.....		.....		.....		.....	.....		.....	.....	.....	.....	.....				
30,900	53,200		53,200	240,169,182	(o)	48,600	220,727,440	(o)	43,800	183,268,485	(q) 628,410	174,943,577						58
38,600	.....		.....	.....		.....	.....		.....	.....	.....	.....						59
43,100	.....		.....	.....		.....	.....		.....	.....	.....	.....						60
34,700	81,500		81,500	269,681,600		74,000	247,191,413		68,200	213,459,806	58,300	184,683,171						61
18,500	60,000		54,800	148,932,217		.....	.....		.....	.....	.....	.....						62
38,200	.....		52,094	302,031,809	(n)	44,990	271,440,543	(n)	44,750	227,490,211	32,796	170,852,661						63
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						64
48,800	80,696		.....	416,134,000		77,950	401,856,000		86,410	399,825,337	75,484	364,574,445						65
41,500	.....		52,500	242,563,000	(n, G)	51,300	220,324,000		67,000	192,253,000	56,400	190,355,000						66
44,900	84,900		75,290	376,764,523		80,150	352,809,582		77,680	326,148,706	72,070	296,678,980						67
24,700	45,200		45,150	171,315,819	(See the N. Y. Edison & Allied Cos.)				32,980	126,197,021	30,000	104,207,062						68
41,600	76,800		75,000	307,909,700		75,000	277,591,025		64,800	232,848,275	59,600	218,245,950						69
19,500	130,000		120,600	222,096,800		125,540	565,609,500		106,400	439,380,300	.....	.....						70
30,300	47,000		.....	219,813,000		41,900	201,094,000		38,800	187,052,800	30,500	177,233,500						71
44,400	76,600		76,600	356,228,046	(n)	63,500	328,712,384		.....	.....	.....	.....						72
41,900	.....		66,300	339,189,800	(n)	72,600	301,548,168	(n)	74,600	278,626,089	65,000	247,311,779						73
39,500	68,000		.....	338,629,000		66,500	319,842,000		66,000	222,927,000	65,000	252,735,540						74
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						75
36,400	67,797		.....	298,387,145	(o)	63,980	285,892,553		67,080	268,618,910	58,645	244,055,341						76
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						77
53,000	82,400		82,400	528,895,495		.....	.....		.....	.....	.....	.....						78
35,500	.....		.....	259,164,000		.....	183,843,000		43,500	151,908,790	.....	.....						79
21,500	55,200		.....	275,550,594		53,275	206,356,017		24,750	113,107,669	.....	.....						80
32,700	53,100		.....	286,820,000		48,100	255,766,000		44,400	237,403,000	39,300	196,911,791						81
33,900	.....		.....	283,520,629	(N)		275,376,599		62,000	258,765,399	.....	.....						82
32,900	34,500		.....	275,965,650		.....	222,132,700		31,000	115,535,700	.....	.....						83
34,200	.....		51,900	294,781,380		57,600	279,334,470		50,200	273,230,332	49,900	260,300,140						84
28,000	54,190		53,000	228,660,184		53,010	213,752,872		43,000	165,088,310	.....	.....						85
36,000	63,000		60,000	283,654,155	(n)	55,100	254,843,000		.....	.....	.....	.....						86
31,100	42,380		35,204	191,081,273		29,754	155,783,691	(l)	22,000	100,344,073	.....	.....						87
27,400	52,400		.....	245,526,000		51,000	237,512,000		54,020	214,065,156	46,300	197,864,432						88
29,200	49,000		49,000	208,399,465		61,500	197,580,149		55,000	195,791,000	33,000	157,662,360						89
33,400	53,720		.....	298,379,513		53,811	289,073,000		41,692	200,750,534	35,919	224,109,866						90
32,500	49,900		.....	249,717,000		44,600	221,118,000		44,400	194,417,500	35,800	177,590,200						91
27,500	.....		39,910	194,822,819		45,800	185,904,592		34,100	146,560,259	.....	.....						92
27,300	.....		34,845	146,744,975	(n)	25,205	120,521,353		.....	.....	.....	.....						93
22,500	54,935		50,000	172,923,000		49,000	135,372,000		38,000	108,600,000	30,000	90,300,000						94
27,200	45,950		45,800	213,808,418	(n)	45,000	226,892,235		62,500	227,630,419	46,300	208,994,394						95
28,700	.....		.....	232,877,000		35,105	171,611,000		27,677	166,214,470	35,000	155,585,707						96
22,900	55,000		53,000	213,612,676	(o)	52,900	222,368,156		.....	.....	.....	.....						97
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						98
22,700	46,400		.....	179,165,000		44,300	171,925,970		35,100	159,430,750	36,400	144,739,433						99
21,800	.....		.....	.....		.....	.....		.....	.....	.....	.....						100
21,000	41,500		.....	148,331,000		36,000	157,892,000		29,000	106,141,300	.....	.....						101
23,000	60,708		.....	199,322,000		65,364	214,167,000		64,000	173,623,725	.....	.....						102
28,200	.....		44,220	147,963,154		.....	.....		.....	.....	.....	.....						103
29,100	.....		46,000	224,426,315		39,222	135,199,859		.....	.....	.....	.....						104
27,200	.....		.....	.....		.....	.....		.....	.....	.....	.....						105
21,200	.....		.....	153,825,600		.....	126,801,100		31,900	123,369,160	27,300	117,956,180						106
17,000	.....		31,790	119,647,273		.....	.....		.....	.....	.....	.....						107
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						108
23,700	.....		54,970	182,918,142	(o)	52,200	165,318,271	(o)	51,792	153,976,958	48,000	138,876,293						109
25,000	58,800		56,000	167,613,529		50,500	173,617,378		52,600	172,222,651	50,300	155,470,639						110
20,800	41,261		.....	172,781,000		46,000	166,244,000		36,392	137,786,000	34,300	121,627,000						111
20,100	.....		.....	149,811,913		.....	153,364,676	(o)	33,200	150,635,115	30,400	128,835,193						112
19,700	.....		36,000	159,666,072		40,000	134,416,934		32,000	128,293,150	.....	.....						113
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						114
22,600	37,200		.....	186,242,950		33,700	174,146,677		.....	164,932,820	(n) 31,000	151,475,140						115
29,500	55,500		.....	226,034,240	(o)	61,000	262,409,515		62,280	214,669,321	59,260	178,047,098						116
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						117
18,500	.....		.....	.....		.....	.....		.....	.....	.....	.....						118
20,500	45,000		40,000	152,957,600		34,000	131,861,909		32,900	123,632,339	.....	.....						119
20,200	(K)		(K)	156,467,174		31,727	135,692,265		28,600	117,679,234	25,800	106,992,465						120
16,400	31,380		30,200	114,835,060	(n)	30,580	116,194,720		.....	107,971,800	.....	.....						121
16,600	26,480		.....	122,579,000		24,600	105,634,000		23,140	104,648,573	.....	.....						122
11,800	.....		.....	.....		.....	.....		.....	.....	.....	.....						123
19,400	31,720		.....	152,885,453		25,340	114,195,401	(n)	27,620	100,462,550	.....	.....						124
14,000	.....		30,750	108,519,670		.....	.....		.....	.....	.....	.....						125
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						126
15,360	24,500		23,500	122,337,055	(o)	25,000	109,786,578		22,500	111,341,210	.....	.....						127
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						128
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						129
15,500	.....		.....	.....		.....	.....		.....	.....	.....	.....						130
18,700	35,030		34,750	151,902,906		31,570	131,017,494		32,530	124,713,651	30,000	108,316,069						131
14,650	32,600		28,100	117,999,180		29,000	107,715,140		31,500	100,957,540	.....	.....						132
11,850	.....		.....	.....		.....	.....		.....	.....	.....	.....						133
12,860	.....		.....	.....		.....	.....		.....	.....	.....	.....						134
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						135
13,200	.....		.....	.....		.....	.....		.....	.....	.....	.....						136
13,300	.....		23,400	93,469,303	(n)	19,000	75,389,189		.....	.....	.....	.....						137
12,700	.....		.....	.....		.....	.....		.....	.....	.....	.....						138
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						139
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						140
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						141
13,660	.....		.....	104,830,000		.....	.....		.....	.....	.....	.....						142
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						.....
580,000	802,245		794,430	4,429,404,096		746,275	4,133,501,842		711,220	3,867,398,041	635,485	3,298,347,874						143
426,000	532,945		532,945	3,409,717,522		420,300	3,021,201,950		392,330	2,557,613,443	371,002	2,421,046,311						144
239,000	286,000		280,000	1,297,239,606		.....	.....		.....	.....	.....	.....						145
179,000	279,250		.....	1,450,484,998		256,760	1,354,895,244		252,000	1,251,502,612	233,230	1,175,430,654						146
239,200	321,000		315,000	2,096,903,000		.....	1,719,820,588		.....	.....	.....	.....						147
80,350	130,500		129,000	654,491,510		112,000	511,103,200		66,200	285,508,300	61,100	252,891,600						148
61,500	.....		39,700	516,071,474	(n)	65,600	476,999,100		.....	410,327,600	.....	.....						149
72,200	.....		.....	621,423,800		.....	604,597,700		.....	591,893,200	.....	.....						150
47,700	98,200		94,600	390,564,500		87,400	350,402,700		79,000	333,654,900	83,100	336,907,650						151
39,600	47,510		45,000	343,930,010		43,690	305,415,945		.....	.....	.....	.....						152
50,900	76,290		74,940	400,668,600		75,834	358,371,100		70,844	324,993,710	60,321	261,996,380						153
14,500	26,100		.....	104,577,805		.....	.....		.....	.....	.....	.....						154
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						155
17,000	31,700		.....	146,233,060	(n)	26,300	125,319,394		.....	.....	.....	.....						156
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						157
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						.....
73,200	107,608		.....	628,832,675	(o)	102,386	606,245,844		.....	594,046,265	(n) 98,991	561,425,403						158
16,200	24,500		23,600	160,099,800	(o)	22,700	156,086,800		.....	137,149,400	.....	112,261,000						
12,200	.....		.....	100,430,000		.....	.....		.....	.....	.....	.....						
11,900	.....		.....	.....		.....	.....		.....	.....	.....	.....						
138,900	.....		298,760	1,177,155,819	(n)	284,660	1,103,063,438		.....	1,063,717,242	(n) 276,380	1,063,504,660						159
68,400	(o) 146,300		150,000	568,889,703	(o)	138,200	544,081,653	(o)	138,100	542,141,625	(o) 132,300	508,481,425						160
75,900	.....		195,730	(r) 592,545,223		300,660	(r) 577,710,827		264,000	(r) 581,706,072	200,000	630,560,494						161
43,800	.....		110,071	377,326,475	(n)	120,318	371,731,556		.....	390,915,742	(n) 116,160	385,707,158						162
39,200	99,600		87,700	333,037,210		99,600	307,432,390		88,800	286,533,764	98,000	266,137,403						163
28,200	(s) 95,937	(s)	91,576	(s) 252,965,140	(s)	94,457	(s) 243,925,965		94,490	257,696,595	94,226	247,490,105						164
28,200	80,000		68,280	230,003,185		75,000	222,131,354		73,000	205,649,608	70,000	184,775,459						165
23,900	.....		40,750	201,191,225		50,500	189,691,700	(G)	43,000	209,658,870	40,000	209,542,400						166
.....	.....		.....	.....		.....	.....		.....	.....	.....	.....						167
20,850	55,000		48,000	184,759,206		54,000	190,485,000		52,000	187,975,148	(o) 44,000	183,000,000						168
71,000	294,445,800		33,000															

102,227	0	355,822,958	36,100	.....	111,750	366,341,465	.....	41,800	.....	110,100	366,341,465	.....	
105,430	95,600	330,309,340	37,700	115,000	86,800	343,354,637		39,200	104,000	89,800	343,646,828		
98,490	98,490	257,065,945	29,350	108,108	103,194	(F) 270,054,975		30,800	95,755	91,403	247,473,090		
86,300	73,000	250,573,893	28,600	85,400	71,600	251,780,404		28,600	86,500	75,400	247,599,220		
42,800	(o) 28,900	213,400,000	24,300	.....	43,000	225,941,425		25,800	.....	41,600	209,370,023		
51,287	16,121	159,433,615	18,200	58,780	57,395	170,343,455		19,450	.....	.....	.....		
48,000	0	157,888,334	18,000	51,000	48,000	169,134,719		19,300	55,000	48,000	182,813,761		

86	The Columbus Railway, Power & Light Company	86	(o)	61,000	(o)	61,000	270,864,584	30,900	.....					
87	Gulf States Utilities Company	87		47,810		36,000	266,182,789	30,400	54,567					
88	The Scranton Electric Company	88		51,400		51,400	263,811,192	30,100	55,500					
89	City of Tacoma, Dept. Public Utilities, Light Division	89		55,000		66,000	253,913,000	29,000	55,000					
90	Birmingham Electric Company	90		48,363		0	252,222,842	28,800	52,820					
91	Kansas Gas & Electric Company	91		50,600		50,600	251,304,100	28,700	54,500					
92	Kentucky Utilities Company	92		56,000		50,500	249,540,548	28,500	68,570					
93	Central Power & Light Company	93		48,025		43,125	249,425,222	28,500	55,270					
94	Long Island Lighting Company System	94		70,500		70,500	244,156,063	27,850	65,300					
95	Penn Central Light & Power Company	95		.....		47,500	234,162,059	26,700	50,300					
96	Pacific Power & Light Company	96		41,250		18,325	230,487,553	26,300	.....					
97	Central Hudson Gas & Electric Corporation	97		53,500		.....	221,840,852	25,300	53,000					
98	Virginia Public Service Company	98		53,115		55,680	220,893,275	25,200	47,500					
99	Dallas Power & Light Company	99	(o)	52,300	(o)	52,000	220,291,750	25,100	56,000					
100	City of Detroit, Public Lighting Commission	100		.....		45,000	217,010,380	24,750	47,000					
101	Atlantic City Electric Company	101		52,900		52,900	213,819,894	24,400	50,000					
102	Florida Power & Light Company	102		65,260		64,880	208,124,600	23,750	.....					
103	West Texas Utilities Company	103		42,915		.....	203,968,162	23,300	.....					
104	Public Service Company of Oklahoma	104		42,500		37,000	200,698,570	22,900	54,200					
105	San Antonio Public Service Company	105		41,700		36,500	199,783,901	22,800	54,500					
106	San Diego Consolidated Gas & Electric Company	106		48,300		48,300	198,800,090	22,650	47,200					
107	Southwestern Gas & Electric Company	107		.....		30,300	196,644,219	22,400	.....					
108	Jersey Central Power & Light Company	108		58,000		54,000	192,586,692	22,000	42,500					
109	Blackstone Valley Gas & Electric Company	109	(o)	46,187	(o)	6,000	192,089,421	21,950	.....					
110	New Bedford Gas & Edison Light Company	110	(o)	51,200	(o)	51,200	190,585,830	21,700	54,100					
111	Memphis Power & Light Company	111	(o)	44,700	(o)	44,700	189,341,440	21,600	49,000					
112	Wisconsin Public Service Corporation and Subsidiary	112	(o)	44,600		.....	185,877,236	21,200	.....					
113	Des Moines Electric Light Company	113		42,000		42,000	185,041,631	21,100	.....					
114	Public Service Company of New Hampshire	114	(o)	43,700	(o)	42,675	181,949,548	20,750	40,000					
115	City of Cleveland, Dept. of Public Utilities	115		37,000		37,000	179,870,560	20,500	.....					
116	Empire District Electric Company	116	(o)	37,100	(o)	37,100	178,540,162	20,380	.....					
117	Pennsylvania Power Company	117		39,000		0	178,076,358	20,300	.....					
118	Sioux City Gas & Electric Co., Iowa Pub. Serv. Co. System	118		39,311		.....	171,071,489	19,530	.....					
119	Indiana Service Corporation	119		35,739		21,000	157,710,391	18,000	.....					
120	Central Illinois Light Company	120		35,000		0	151,421,136	17,300	38,200					
121	Cumberland County Power & Light Company	121		39,815		18,815	149,093,897	17,020	43,600					
122	Indiana General Service Company	122		29,640		2,840	147,896,790	16,880	31,390					
123	Mississippi Power & Light Company	123		32,074		.....	146,433,090	16,700	.....					
124	Tampa Electric Company	124		27,840		24,600	143,522,953	16,380	35,630					
125	Kansas Power & Light Company	125		29,650		.....	143,502,741	16,380	.....					
126	Interstate Power Company (Del.) and Subsidiaries	126		40,403		33,480	141,315,424	16,130	.....					
127	Delaware Power & Light Company	127		28,119		0	136,633,985	15,600	28,700					
128	Iowa Railway & Light Corporation	128		32,000		32,000	134,821,422	15,390	.....					
129	The Connecticut Power Company	129		43,452		11,140	132,960,016	15,180	.....					
130	South Carolina Power Company	130		31,200		.....	130,897,921	14,940	.....					
131	Moline-Rock Island Manufacturing Company	131		33,590		29,000	130,452,095	14,900	41,380					
132	Staten Island Edison Corporation	132	(o)	31,700	(o)	31,700	128,454,330	14,660	36,000					
133	United Power & Light Corporation (of Kansas)	133		26,000		.....	127,308,532	14,530	.....					
134	Mountain States Power Company	134		.....		.....	127,099,816	14,500	.....					
135	Wisconsin Valley Electric Company	135		31,360		13,920	126,791,351	14,470	29,800					
136	Luzerne County Gas & Electric Corporation	136	(o)	25,130	(o)	41,750	123,216,441	14,080	41,000					
137	Mississippi Power Company	137		26,783		.....	118,526,461	13,530	.....					
138	Tennessee Public Service Company	138		22,387		77	112,918,808	12,900	23,500					
139	El Paso Electric Company (and Affiliates)	139		24,034		24,034	110,485,989	12,600	25,125					
140	Florida Power Corporation and Subsidiaries	140		25,800		25,800	109,489,363	12,500	25,300					
141	Bangor Hydro Electric Company	141	(o)	23,830	(o)	23,830	106,550,576	12,160	.....					
142	Wheeling Electric Company	142		26,980		0	100,652,334	11,500	.....					
	Total (C)	.....	.....	.....	.....	.....	94,829,349,592	.....	.....					
	Canada													
143	Hydro-Electric Power Commission of Ontario	1		915,945		699,630	4,387,316,157	500,800	943,710					
144	The Shawinigan Water & Power Company	2		540,500		.....	3,436,436,460	392,300	545,600					
145	Canadian Hydro-Electric Corporation, Ltd. System	3		485,775		485,075	2,414,375,792	275,600	451,700					
146	Montreal Light, Heat & Power Consolidated	4		285,150		142,700	1,557,929,949	177,800	312,075					
147	Duke-Price Power Company, Ltd	5		307,000		307,000	1,518,632,376	173,400	341,000					
148	Winnipeg Electric Company (J)	6		132,700		132,700	614,665,600	70,200	121,500					
149	West Kootenay Power & Light Company, Ltd	7		83,500		83,500	591,772,849	67,500	.....					
150	Canadian Niagara Power Company, Ltd	8		.....		74,500	490,148,000	55,950	.....					
151	British Columbia Electric Railway Company, Ltd. (D)	9	(o)	100,800	(o)	100,800	425,510,139	48,500	104,000					
152	Canada Northern Power Corporation, Ltd. System	10		57,270		57,270	418,226,810	47,700	51,680					
153	City of Winnipeg Hydro-Electric System	11		89,100		85,845	412,080,147	47,000	89,223					
154	Calgary Power Company, Ltd	12		45,300		35,600	188,668,281	21,500	.....					
155	The Nova Scotia Power Commission	13		.....		.....	173,924,966	19,850	.....					
156	Southern Canada Power Company, Ltd	14		41,000		41,000	159,873,880	18,250	40,800					
157	Montreal Island Power Company	15		44,250		44,250	146,048,890	16,670	41,225					
	Total	.....	.....	.....	.....	.....	16,935,610,296	.....	.....					
	Mexico													
158	The Mexican Light & Power Company, Ltd	.....	(o)	122,907	(o)	122,907	691,150,190	78,900	.....					
	Cia. Agricola y de Fuerza Electrica del Rio Conchos, S. A	.....	.....	.....	....	1931 Data	not available	.....	.....					19
	The Guanajuato Power & Electric Company	.....	.....	.....	....	1931 Data	not available	.....	.....					19
	Puebla Tramway, Light & Power Company	.....	.....	.....	....	1931 Data	not available	.....	.....					19
	Electric Railways and Electrified Railroads													
159	Interborough Rapid Transit Company	1		301,830		301,830	1,198,884,267	136,900	.....					
160	Williamsburgh Power Plant Corporation (B. M. T.)	2	(o)	162,600	(o)	162,600	642,157,665	73,300	.....					
161	Chicago Surface Lines	3		.....		.....	595,733,093	68,000	.....					
162	Philadelphia Rapid Transit Company	4		102,227		0	333,822,958	38,100	.....					
163	The Pennsylvania Railroad (Long Island City Gen. Station)	5	(o)	105,430		95,600	330,309,340	37,700	115,000					
164	Boston Elevated Railway	6		98,490		98,490	257,065,945	29,350	108,108					
165	The New York Central Railroad Company	7		86,300		73,000	250,573,893	28,600	85,400					
166	The New York, New Haven & Hartford Railroad Company	8	(o)	42,800	(o)	28,900	213,400,000	24,300	.....					
167	St. Louis Public Service Company	9		51,287		16,121	159,433,615	18,200	58,780					
168	Pacific Electric Railway Company	10		48,000		0	157,888,334	18,000	51,000					
169	Twin City Rapid Transit Company	11	(o)	39,798	(o)	38,580	126,174,466	14,400	.....					
170	Norfolk & Western Railway Company	12		34,300		27,300	116,745,039	13,300	31,500					
171	Chicago, Milwaukee, St. Paul & Pacific Railroad Company (m)	.....	.....	.....	.....	.....	91,042,859	10,390	.....					
172	The Connecticut Company (m)	.....	.....	.....		10,100	89,641,092	10,220	.....					
	Total	.....	.....	.....	.....	.....	4,562,872,566	.....	.....					

*Certain company names in last year's table do not appear in this. The causes are (1) change of name; (2) absorption or merger into another system; (3) inclusion without loss of corporate identity in a system comprising units formerly separate. The following list gives the former names and the names under which the operations are *now included*, minor changes of name being omitted:

Broad River Power Co.
Assoc. Gas & Elec. System (South Carolina Group)

Erie Lighting Co.
Assoc. Gas & Elec. System (West. Penna. Group)

Interstate Public Service Co.
Public Service Co. of Indiana

Pennsylvania Electric Co.
Assoc. Gas & Elec. System (West. Penna. Group)

Pennsylvania-New Jersey Power System
Assoc. Gas & Elec. System (Eastern Pa. & N. J. Group)

Salem Electric Lighting Co.
New England Power Association System

Terre Haute, Indianapolis & Eastern Traction Co.
Public Service Co. of Indiana.

(a) Company practice varies as to the period for which the peak is determined. For 1931 peak data were requested on a 30-minute basis. For that or a shorter period the returns have been entered without comment. Those for a longer period are noted. No distinction has been made between estimated and observed values. In earlier years both instantaneous and 30-minute peaks were called for. Those for less than fifteen minutes were grouped with the former, all others with the latter. For 1925, 1926 and 1927 instantaneous values are given where ... in many instances those for some longer p... be used. In some the duration was not stat... an excessive number of footnotes these ... have all been entered without comment. ... formation will be found in earlier issues of th...

(b) Less energy supplied to other electric com...

(c) Chiefly Metropolitan Edison Co. and New ... & Light Co.

(d) Includes 12,500 kw. joint operation with C... Edison Co.

(e) Capacity of major generating plants 74,265 ...

(f) Includes 24,239,872 kw.-hr. joint operatio... monwealth Edison Co.

61,000	(o) 61,000	270,864,584	30,900	.....	71,000	294,445,800	33,600	70,000	70,000	315,558,310	36,000		
47,810	36,000	266,182,789	30,400	54,567	52,000	293,365,397	33,500	48,998	47,000	273,182,834	31,100		

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61,000	(c)	61,000	270,864,584	30,900	.....	71,000	294,445,800	33,600	70,000	70,000	315,558,310	36,0
47,810		36,000	266,182,789	30,400	54,567	52,000	293,365,397	33,500	48,998	47,000	273,182,834	31,1
51,400		51,400	263,811,192	30,100	55,500	.....	279,155,000	31,860	58,200	.....	240,508,000	27,4
55,000		66,000	253,913,000	29,000	55,000	53,000	254,074,415	29,000	55,000	54,300	255,771,531	29,2
48,363		0	252,222,842	28,800	52,820	52,464	277,437,821	31,700	.....	54,820	292,759,162	33,4
50,600		50,600	251,304,100	28,700	54,500	52,500	271,396,600	30,980	.....	62,400	284,354,000	32,5
56,000		50,500	249,540,548	28,500	68,570	68,570	252,292,869	28,800	(e) 60,000	.....	240,724,354	27,5
48,025		43,125	249,425,222	28,500	55,270	55,270	276,668,160	31,500	42,800	.....	239,756,655	27,3
70,500		70,500	244,156,063	27,850	65,300	64,900	222,301,296	25,375	58,200	48,000	197,097,106	22,5
.....		47,500	234,162,059	26,700	50,300	50,100	243,323,574	27,700	51,550	50,300	237,817,248	27,2
41,250		18,325	230,487,553	26,300	.....	42,775	220,440,374	25,100	.....	.....	251,759,000	28,7
53,500		.....	221,840,852	25,300	53,000	50,000	195,689,541	22,300	56,500	55,400	200,566,867	22,9
53,115		55,680	220,893,275	25,200	47,500	44,400	193,392,263	22,100	.....	.....	.....	.....
52,300	(o)	52,000	220,291,750	25,100	56,000	53,000	215,889,590	24,600	.....	55,400	199,099,200	22,7
.....		45,000	217,010,380	24,750	47,000	44,700	206,514,320	23,500	47,000	44,000	190,900,800	21,8
52,900		52,900	213,819,894	24,400	50,000	.....	201,758,000	22,900	48,000	.....	184,172,000	21,0
65,260		64,880	208,124,600	23,750	.....	67,940	207,310,965	23,600	.....	59,208	202,110,030	23,0
42,915		.....	203,968,162	23,300	.....	41,140	231,817,948	26,400	41,000	39,000	246,515,315	28,2
42,500		37,000	200,698,570	22,900	54,200	52,800	268,724,289	30,700	47,000	.....	255,220,126	29,1
41,700		36,500	199,783,901	22,800	54,500	.....	238,979,012	27,280	53,400	51,600	238,200,935	27,2
48,300		48,300	198,800,090	22,650	47,200	47,000	179,709,699	20,500	45,300	.....	185,639,011	21,2
.....		30,300	196,644,219	22,400	.....	.....	163,474,091	18,650	.....	.....	149,696,794	17,0
58,000		54,000	192,586,692	22,000	42,500	40,000	144,902,031	16,500	.....	.....	.....	.....
46,187	(o)	6,000	192,089,421	21,950	.....	49,815	183,442,323	20,900	.....	55,515	207,701,144	23,7
51,200	(o)	51,200	190,585,830	21,700	54,100	53,000	195,293,900	22,300	58,800	58,000	219,020,744	25,0
44,700	(o)	44,700	189,341,440	21,600	49,000	48,000	195,429,828	22,300	.....	45,000	182,112,000	20,8
44,600		.....	185,877,236	21,200	.....	48,300	205,587,325	23,400	50,400	.....	176,194,115	20,1
42,000		42,000	185,041,631	21,100	.....	42,500	183,658,907	20,950	.....	42,500	172,539,101	19,7
43,700	(o)	42,675	181,949,548	20,750	40,000	39,700	157,222,444	17,900	.....	.....	.....	.....
37,000		37,000	179,870,560	20,500	.....	38,000	189,781,760	21,650	38,300	.....	198,179,340	22,6
37,100	(o)	37,100	178,540,162	20,380	.....	49,600	224,158,905	25,600	.....	60,600	258,682,003	29,5
39,000		0	178,076,358	20,300	.....	45,000	232,425,592	26,490	.....	.....	.....	.....
39,311		.....	171,071,489	19,530	.....	42,500	175,304,555	19,950	42,400	40,500	162,477,080	18,5
35,739		21,000	157,710,391	18,000	.....	37,400	178,538,313	20,380	41,000	.....	180,016,985	20,5
35,000		0	151,421,136	17,300	38,200	37,500	171,834,023	19,600	40,900	39,400	177,338,443	20,2
39,815		18,815	149,093,897	17,020	43,600	43,220	143,380,401	16,350	41,510	41,940	144,364,260	16,4
29,640		2,840	147,896,790	16,880	31,390	.....	146,368,000	16,700	23,620	.....	145,405,000	16,6
32,074		.....	146,433,090	16,700	.....	31,000	138,781,877	15,840	.....	25,508	103,748,759	11,8
27,840		24,600	143,522,953	16,380	35,630	.....	178,992,370	20,400	.....	33,000	170,887,397	19,4
29,650		.....	143,502,741	16,380	.....	28,700	142,385,334	16,250	.....	27,800	122,992,015	14,0
40,403		33,480	141,315,424	16,130	.....	.....	142,532,297	16,250	.....	.....	.....	.....
28,119		0	136,633,985	15,600	28,700	27,880	137,457,239	15,700	31,200	29,700	134,571,700	15,3
32,000		32,000	134,821,422	15,390	.....	.....	.....	.....	.....	.....	.....	.....
43,452		11,140	132,960,016	15,180	.....	24,755	139,618,715	15,940	.....	.....	.....	.....
31,200		.....	130,897,921	14,940	.....	26,900	121,419,692	13,860	.....	29,440	136,213,088	15,5
33,590		29,000	130,452,095	14,900	41,380	40,000	157,500,686	17,990	40,480	40,000	164,206,522	18,7
31,700	(o)	31,700	128,454,330	14,660	36,000	31,500	142,486,580	16,250	37,000	31,800	128,665,860	14,6
26,000		.....	127,308,532	14,530	.....	27,150	127,822,014	14,590	.....	23,230	103,802,181	11,8
.....		.....	127,099,816	14,500	.....	.....	123,611,405	14,100	.....	.....	112,617,618	12,8
31,360		13,920	126,791,351	14,470	29,800	25,000	118,703,271	13,550	.....	.....	.....	.....
25,130	(o)	41,750	123,216,441	14,080	41,000	40,000	129,087,117	14,700	29,610	26,810	115,530,335	13,2
26,783		.....	118,526,461	13,530	.....	27,912	115,634,958	13,200	.....	30,300	116,745,731	13,3
22,387		77	112,918,808	12,900	23,500	23,144	114,480,898	13,070	.....	23,065	111,870,280	12,7
24,034		24,034	110,485,989	12,600	25,125	24,000	112,612,701	12,850	.....	.....	.....	.....
25,800		25,800	109,489,363	12,500	25,300	.....	103,891,909	11,850	.....	.....	.....	.....
23,830	(o)	23,830	106,550,576	12,160	.....	.....	.....	.....	.....	.....	.....	.....
26,980		0	100,652,334	11,500	.....	.....	113,823,000	13,000	.....	.....	119,716,000	13,6
.....		.....	94,829,349,592	.....	.....	.....	.....	.....	.....	.....	.....	.....
915,945		699,630	4,387,316,157	500,800	943,710	937,320	5,077,430,835	580,000	857,950	847,710	5,071,853,732	580,0
540,500		.....	3,436,436,460	392,300	545,600	.....	3,226,014,549	368,000	(g) 538,300	.....	3,726,436,341	426,0
485,775		485,075	2,414,375,792	275,600	451,700	450,000	2,525,560,158	288,000	395,000	387,000	2,090,788,460	239,0
285,150		142,700	1,557,929,949	177,800	312,075	310,000	1,650,636,536	188,300	292,020	.....	1,568,864,226	179,0
307,000		307,000	1,518,632,376	173,400	341,000	341,000	2,012,869,376	229,000	351,000	351,000	2,093,829,000	239,2
132,700		132,700	614,665,600	70,200	121,500	119,750	598,508,500	68,400	125,400	124,200	703,982,200	80,3
83,500		83,500	591,772,849	67,500	.....	83,700	599,257,403	68,400	.....	74,800	539,626,687	61,5
.....		74,500	490,148,000	55,950	.....	.....	614,411,500	70,100	.....	.....	632,261,900	72,2
o) 100,800	(o)	100,800	425,510,139	48,500	104,000	100,200	437,731,126	50,000	98,900	94,000	418,075,320	47,7
. 57,270		57,270	418,226,810	47,700	51,680	50,000	367,130,780	41,900	46,420	46,000	347,797,680	39,6
89,100		85,845	412,080,147	47,000	89,223	.....	414,195,787	47,300	73,400	.....	445,579,835	50,9
45,300		35,600	188,668,281	21,500	.....	44,860	139,302,262	15,900	29,500	.....	126,876,336	14,5
.....		.....	173,924,966	19,850	.....	.....	151,414,019	17,850	.....	.....	.....	.....
41,000		41,000	159,873,880	18,250	40,800	.....	170,619,052	19,480	31,000	31,000	149,105,920	17,0
44,250		44,250	146,048,890	16,670	41,225	41,000	105,805,180	12,070	.....	.....	.....	.....
.....		.....	16,935,610,296	.....	.....	.....	.....	.....	.....	.....	.....	.....
122,907	(o)	122,907	691,150,190	78,900	.....	121,485	681,822,792	77,800	.....	111,140	641,828,127	73,2
.....	.....	1931 Data	not available...	.....	.....	....1930 Data	not available...	.....	.....	22,000	141,967,487	16,2
.....	.....	1931 Data	not available...	.....	.....	....1930 Data	not available...	.....	.....	18,134	107,111,000	12,2
.....	.....	1931 Data	not available...	.....	.....	....1930 Data	not available...	.....	21,590	.....	104,808,000	11,9
301,830		301,830	1,198,884,267	136,900	.....	303,400	1,228,301,211	140,000	.....	304,460	1,217,047,463	138,9
162,600	(o)	162,600	642,157,665	73,300	.....	170,000	618,219,724	70,600	(o) 154,100	159,000	599,442,974	68,4
.....		.....	595,733,093	68,000	.....	197,574	624,776,062	71,200	.....	200,698	(p) 664,908,358	75,9
102,227		0	333,822,958	38,100	.....	111,750	366,341,403	41,800	.....	116,162	384,076,148	43,8
105,430		95,600	330,309,340	37,700	115,000	86,800	343,354,637	39,200	104,000	89,800	343,646,828	39,2
98,490		98,490	257,065,945	29,350	108,108	103,194	(F) 270,054,975	30,800	95,755	91,403	247,473,090	28,2
86,300		73,000	250,573,893	28,600	85,400	71,600	251,780,404	28,600	86,500	75,400	247,599,220	28,2
42,800	(o)	28,900	213,400,000	24,300	.....	43,000	225,941,425	25,800	.....	41,600	209,370,023	23,9
51,287		16,121	159,433,615	18,200	58,780	57,395	170,343,455	19,450	.....	.....	.....	.....
48,000		0	157,888,334	18,000	51,000	48,000	169,134,719	19,300	55,000	48,000	182,813,761	20,8
39,798	(o)	38,580	126,174,466	14,400	.....	48,000	133,337,207	15,200	.....	49,732	140,190,412	16,0
34,300		27,300	116,745,039	13,300	31,500	24,000	132,339,094	15,100	.....	30,000	134,368,264	15,3
.....		.....	91,042,859	10,390	.....	.....	124,593,517	14,200	.....	.....	156,186,340	17,8
.....		10,100	89,641,092	10,220	.....	25,050	106,660,046	12,180	.....	16,500	120,427,038	13,7
.....		.....	4,562,872,566	.....	.....	.....	.....	.....	.....	.....	.....	.....

ower System
(Eastern Pa. & N. J. Group)

ciation System
Eastern Traction Co.
na.

es as to the period for which the or 1931 peak data were requested For that or a shorter period the red without comment. Those for d. No distinction has been made observed values. In earlier years 30-minute peaks were called for. en minutes were grouped with the the latter. For 1925, 1926 and 1927 instantaneous values are given where available, but in many instances those for some longer periods had to be used. In some the duration was not stated. To avoid an excessive number of footnotes these various cases have all been entered without comment. Detailed information will be found in earlier issues of the Supplement.

(*b*) Less energy supplied to other electric companies.

(*c*) Chiefly Metropolitan Edison Co. and New Jersey Power & Light Co.

(*d*) Includes 12,500 kw. joint operation with Commonwealth Edison Co.

(*e*) Capacity of major generating plants 74,265 kw.

(*f*) Includes 24,239,872 kw.-hr. joint operation with Commonwealth Edison Co.

(*g*) Over ten-minute period. Electric only. Does not include 41,000 kw. hydraulic.

(*h*) Includes Broad River Power Co. and Lexington Water Power Co. in 1931. Prior to 1931 Broad River Power Co. only.

(*i*) Chiefly Pennsylvania Electric Co., Erie Lighting Co., Clarion River Power Co. and Youghiogheny Hydro-Electric Corp.

(*j*) Includes large supply to Commonwealth Edison Co.

(*k*) Kva.

(*l*) For Texas Division.

(*m*) These companies are listed, though their output in 1931 fell below 100,000,000 kw.-hr., because they have been included in the pas temporary.

(*n*) Over 30-minute pe

(*o*) Over one-hour perio

(*p*) A.-c. input.

(*q*) Over eight-hour per

(*r*) Output measured o

(*s*) Converted a.c. meas

(*t*) Includes station use

(*A*) Energy consumed.

(*B*) Includes the Sout California Power C 1926, Desert Water

36,000	63,000	60,000	283,654,155	(n)	55,100	234,845,000						
31,100	42,380	35,204	191,081,273		29,754	155,783,691	(l)	22,000	100,344,073			87
27,400	52,400		245,526,000		51,000	237,512,000		54,020	214,065,156	46,300	197,864,432	88
29,200	49,000	49,000	208,399,465		61,500	197,580,149		55,000	195,791,000	33,000	157,662,360	89
33,400	53,720		298,379,513		53,811	289,073,000		41,692	200,750,534	35,919	224,109,866	90
32,500	49,900		249,717,000		44,600	221,118,000		44,400	194,417,500	35,800	177,590,200	91
27,500		39,910	194,822,819		45,800	185,904,592		34,100	146,560,259			92
27,300		34,845	146,744,975	(n)	25,205	120,521,353						93
22,500	54,935	50,000	172,923,000		49,000	135,372,000		38,000	108,600,000	30,000	90,300,000	94
27,200	45,950	45,800	213,808,418	(n)	45,000	226,892,235		62,500	227,630,419	46,300	208,994,394	95
28,700			232,877,000		35,105	171,611,000		27,677	166,214,470	35,000	155,585,707	96
22,900	55,000	53,000	213,612,676	(o)	52,900	222,368,156						97
												98
22,700	46,400		179,165,000		44,300	171,925,970		35,100	159,430,750	36,400	144,739,433	99
21,800												100
21,000	41,500		148,331,000		36,000	157,892,000		29,000	106,141,300			101
23,000	60,708		199,322,000		65,364	214,167,000		64,000	173,623,725			102
28,200		44,220	147,963,154									103
29,100		46,000	224,426,315		39,222	135,199,859						104
27,200												105
21,200			153,825,600			126,801,100		31,900	123,369,160	27,300	117,956,180	106
17,000		31,790	119,647,273									107
												108
23,700		54,970	182,918,142	(o)	52,200	165,318,271	(o)	51,792	153,976,958	48,000	138,876,293	109
25,000	58,800	56,000	167,613,529		50,500	173,617,378		52,600	172,222,651	50,300	155,470,639	110
20,800	41,261		172,781,000		46,000	166,244,000		36,392	137,786,000	34,300	121,627,000	111
20,100			149,811,913			153,364,676	(o)	33,200	150,635,115	30,400	128,835,193	112
19,700		36,000	159,666,072		40,000	134,416,934		32,000	128,293,150			113
												114
22,600	37,200		186,242,950		33,700	174,146,677			164,932,820	(n) 31,000	151,475,140	115
29,500	55,500		226,034,240	(o)	61,000	262,409,515		62,280	214,669,321	59,260	178,047,098	116
												117
18,500												118
20,500	45,000	40,000	152,957,600		34,000	131,861,909		32,900	123,632,339			119
20,200	(K)	(K)	156,467,174		31,727	135,692,265		28,600	117,679,234	25,800	106,992,465	120
16,400	31,380	30,200	114,835,060	(n)	30,580	116,194,720			107,971,800			121
16,600	26,480		122,579,000		24,600	105,634,000		23,140	104,648,573			122
11,800												123
19,400	31,720		152,885,453		25,340	114,195,401	(n)	27,620	100,462,550			124
14,000		30,750	108,519,670									125
												126
15,360	24,500	23,500	122,337,055	(o)	25,000	109,786,578		22,500	111,341,210			127
												128
												129
15,500												130
18,700	35,030	34,750	151,902,906		31,570	131,017,494		32,530	124,713,651	30,000	108,316,069	131
14,650	32,600	28,100	117,999,180		29,000	107,715,140		31,500	100,957,540			132
11,850												133
12,860												134
												135
13,200												136
13,300		23,400	93,469,303	(n)	19,000	75,389,189						137
12,700												138
												139
												140
												141
13,660			104,830,000									142
580,000	802,245	794,430	4,429,404,096		746,275	4,133,501,842		711,220	3,867,398,041	635,485	3,298,347,874	143
426,000	532,945	532,945	3,409,717,522		420,300	3,021,201,950		392,330	2,557,613,443	371,002	2,421,046,311	144
239,000	286,000	280,000	1,297,239,606									145
179,000	279,250		1,450,484,998		256,760	1,354,895,244		252,000	1,251,502,612	233,230	1,175,430,654	146
239,200	321,000	315,000	2,096,903,000			1,719,820,588						147
80,350	130,500	129,000	654,491,510		112,000	511,103,200		66,200	285,508,300	61,100	252,891,600	148
61,500		39,700	516,071,474	(n)	65,600	476,999,100			410,327,600			149
72,200			621,423,800			604,597,700			591,893,200			150
47,700	98,200	94,600	390,564,500		87,400	350,402,700		79,000	333,654,900	83,100	336,907,650	151
39,600	47,510	45,000	343,930,010		43,690	305,415,945						152
50,900	76,290	74,940	400,668,600		75,834	358,371,100		70,844	324,993,710	60,321	261,996,380	153
14,500	26,100		104,577,805									154
												155
17,000	31,700		146,233,060	(n)	26,300	125,319,394						156
												157
73,200	107,608		628,832,675	(o)	102,386	606,245,844			594,046,265	(n) 98,991	561,425,403	158
16,200	24,500	23,600	160,099,800	(o)	22,700	156,086,800			137,149,400		112,261,000	
12,200			100,430,000									
11,900												
138,900		298,760	1,177,155,819	(n)	284,660	1,103,063,438			1,063,717,242	(n) 276,380	1,063,504,660	159
68,400	(o) 146,300	150,000	568,889,703	(o)	138,200	544,081,653	(o)	138,100	542,141,625	(o) 132,300	508,481,425	160
75,900		195,730	(r) 592,545,223		300,660	(r) 577,710,827		264,000	(r) 581,706,072	200,000	630,560,494	161
43,800		110,071	377,326,475	(n)	120,318	371,731,556			390,915,742	(n) 116,160	385,707,158	162
39,200	99,600	87,700	333,037,210		99,600	307,432,390		88,800	286,533,764	98,000	266,137,403	163
28,200	(s) 95,937	(s) 91,576	(s) 252,965,140	(s)	94,457	(s) 243,925,965		94,490	257,696,595	94,226	247,490,105	164
28,200	80,000	68,280	230,003,185		75,000	222,131,354		73,000	205,649,608	70,000	184,775,459	165
23,900		40,750	201,191,225		50,500	189,691,700	(G)	43,000	209,658,870	40,000	209,542,400	166
												167
20,850	55,000	48,000	184,759,206		54,000	190,485,000		52,000	187,975,148	(o) 44,000	183,000,000	168
16,000		46,865	135,530,869	(o)	45,333	137,695,684			140,216,985	(n) 24,460	144,413,357	169
15,300		30,000	127,944,156			123,759,732		38,500	106,426,752			170
17,830			(A) 162,274,409			(A) 148,560,111			(A) 138,083,293		136,993,694	171
13,700		18,500	109,993,477			114,168,609			115,769,700			172

e past and the decrease is assumed to be

e period.

period. Actual or estimated.

r period.

ed on d.c. side.

measured on d.c. side; plus generated d.c.

n use.

ned.

Southern Sierras Power Co., Nevada-
er Co. and Yuma Utilities Co. (prior to
Water, Oil and Irrigation Co.)

(C) Canadian Niagara Power Co., Ltd., (see Canada), included in Niagara Hudson Power Corp. System, also St. Lawrence Power Co., Ltd., (Canada).

(D) Lower mainland system only.

(E) Includes Kentucky & West Virginia Power Co. and Kingsport Utilities, Inc., in 1931 and 1930.

(F) A.-c. output. Prior to 1930 the output given is kw.-hr. generated as d.c. or after conversion to d.c.

(G) On generating plant only.

(H) Includes in 1931 New York Edison Co., Brooklyn Edison Co., Inc., New York & Queens Electric Light & Power Co. and United Electric Light & Power Co.; in 1930, 1929, 1928 also Yonkers Electric Light & Power Co. In 1927 also included Westchester Lighting Co., Northern Westchester Lighting Co., Peekskill Lighting & Railroad Co. and Bronx Gas & Electric Co. but not Brooklyn Edison Co., Inc. (see also Supplement of April 30, 1927).

(I) Covers the period July 1 to December 31.

(J) Includes Manitoba Power Co., Ltd., also in 1931, Northwestern Power Co., Ltd.

(K) Peak included in Illinois Electric Power Co.

(L) Not comparable with previous years because of merger.

(M) Operations for 1931, 1930, 1929, 1928 and 1927 include Bridgeport and New Haven divisions; 1926 figures for Bridgeport division only.

(N) 25-cycle, 18,300 instantaneous, 18,000 half-hour May 11; 60-cycle, 49,000 instantaneous, 48,500 half-hour Dec. 19.

For explanations and comments relating to these statistics the *Electrical World* of May 7, 1932, should be consulted.

Table II—Detailed Data on
of Public Utility Systems H

Line No.	Section and System	Generator Rating, Dec. 31, 1931				Generated and Purchased Output, 1931			
		Fuel Burning Plants		Hydro Plants					
		No. of Plants	Rating of Generators, Kw.	No. of Plants	Rating of Generators, Kw.	Total Output, Kw.-Hr.	Generated (Net), Kw.-Hr.	Purchased, Kw.-Hr.	Dome Servi
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10
	New England States								
1	New England Power Association System	19	415,250	28	338,180	1,987,327,572	1,539,556,672	447,770,900	177,75
2	The Edison Electric Illuminating Company of Boston	3	375,860	1	(L) 50	1,048,605,842	821,547,942	227,057,900	167,54
3	The Connecticut Electric Service Company System	4	109,220	12	57,475	552,059,756	429,797,061	122,262,695	68,54
4	Western Massachusetts Companies System	4	94,350	6	66,985	(b) 443,000,000	(b) 294,000,000	149,000,000	40,46
5	Central Maine Power Company System	2	13,500	24	109,770	440,667,827	427,924,767	12,743,060	28,85
6	Montaup Electric Company	1	73,000	0	0	435,364,000	417,578,000	17,786,000	
7	Hartford Electric Light Company	2	126,000	1	1,500	368,970,842	290,850,550	(e) 78,120,292	38,74
8	The United Illuminating Company	2	142,500	0	0	278,062,000	278,062,000	0	52,62
9	Blackstone Valley Gas & Electric Company	1	33,500	3	1,750	192,089,421	6,844,903	185,244,518	14,62
10	New Bedford Gas & Edison Light Company	1	92,000	0	0	190,585,830	190,585,830	0	12,00
11	Public Service Company of New Hampshire	6	43,810	25	40,061	181,949,548	167,255,504	14,694,044	18,41
12	Cumberland County Power & Light Company	2	36,000	8	25,812	149,093,897	102,434,697	46,659,200	20,09
13	The Connecticut Power Company	0	0	2	9,600	132,960,016	32,142,571	100,817,445	11,81
14	Bangor Hydro Electric Company	0	0	12	30,935	106,550,576	106,472,746	77,830	(i) 13,65
	Totals for section	47	1,554,990	122	682,118	6,507,287,127	5,105,053,243	1,402,233,884	
	Middle Atlantic States								
15	Niagara Hudson Power Corporation System (j)	8	(L) 610,000	101	(L) 1,025,904	5,911,409,390	4,974,265,471	937,143,919	(k) 376,34
16	The New York Edison System (l)	8	(L) 2,057,700	0	0	5,138,200,000	5,138,200,000	0	(m) 1,616,6
17	Philadelphia Electric Company System	10	(L, x) 744,800	3	(L) 253,765	3,032,323,879	2,910,841,564	121,482,315	315,85
18	Public Service Electric & Gas Company (N. J.)	5	556,450	0	0	2,170,512,600	1,882,029,971	288,482,629	317,32
19	The West Penn Electric Company Subsidiaries	29	(D) 452,049	12	56,465	1,693,855,089	1,661,442,063	32,413,026	141,73
20	Pennsylvania Power & Light Company	19	320,167	21	44,702	1,483,177,247	1,236,840,593	246,336,654	129,50
21	Duquesne Light Company	3	(p) 439,000	0	0	1,364,318,513	1,344,781,932	19,536,581	208,60
22	Assoc. Gas & Elec. System (Eastern Pa. & N. J. Group) (q)	4	219,000	5	22,198	706,351,308	647,578,817	58,772,491	59,21
23	Pennsylvania Water & Power Company	1	20,000	1	111,000	506,218,600	502,955,100	3,263,500	
24	N. Y. State Elec. & Gas Corp. Group (Assoc. G. & E. System)	10	63,405	30	15,266	430,009,374	206,693,340	223,316,034	66,38
25	Assoc. Gas & Elec. System (West. Penna. Group) (s)	10	101,086	2	48,000	411,565,334	409,532,870	2,032,464	44,85
26	Rochester Gas & Elec. Corp. Group (Assoc. G. & E. System)	6	77,975	14	48,950	366,281,440	337,153,170	29,128,270	56,49
27	Westchester Lighting Company	3	10,550	0	0	357,430,320	0	(t) 357,430,320	(o) 165,78
28	The Yonkers Electric Light & Power Company	0	0	0	0	317,666,263	0	317,666,263	(m) 27,32
29	The Scranton Electric Company	4	(w) 123,500	0	0	263,811,192	263,166,692	644,500	27,43
30	Long Island Lighting Company System	10	170,150	0	0	244,156,063	244,149,930	6,133	66,46
31	Penn Central Light & Power Company	4	76,350	3	4,420	234,162,059	233,525,770	636,289	27,51
32	Central Hudson Gas & Electric Corporation	2	17,000	6	24,100	221,840,852	83,575,900	138,264,952	27,12
33	Atlantic City Electric Company	3	(x) 123,500	0	0	213,819,894	213,814,644	5,250	33,63
34	Jersey Central Power & Light Company	5	151,300	1	350	192,586,692	273,378,401	(y) —80,791,709	36,56
35	Pennsylvania Power Company	0	0	0	0	178,076,358	0	178,076,358	19,55
36	Staten Island Edison Corporation	1	47,500	0	0	128,454,330	125,441,230	3,013,100	18,88
37	Luzerne County Gas & Electric Corporation	2	55,000	0	0	123,216,441	183,104,270	—59,887,829	12,81
	Totals for section (j)	147	6,436,482	199	1,655,120	25,689,443,238	22,872,471,728	2,816,971,510	
	East North Central States								
38	Commonwealth Edison Company	5	1,090,500	0	0	4,226,257,000	2,566,217,000	1,660,040,000	560,58
39	The Detroit Edison Company	4	837,000	(L) 7	9,160	2,170,254,600	2,167,434,400	2,820,200	(k) 336,84
40	The Ohio Power Company	13	(D) 383,345	3	1,350	1,456,252,361	1,410,544,016	45,708,345	80,62
41	Public Service Company of Northern Illinois	14	(L) 425,735	3	4,100	1,361,938,056	562,314,536	799,623,520	142,31
42	The Cleveland Electric Illuminating Company	4	478,000	0	0	1,316,116,027	1,308,150,625	7,965,402	186,18
43	Super-Power Company of Illinois	1	215,000	0	0	1,253,830,208	1,173,911,400	79,918,808	
44	Columbia Gas & Electric Corporation System	6	389,250	0	0	1,162,409,020	1,080,263,450	82,145,570	154,19
45	The North American Co. System (Wis.-Michigan Group)	9	420,189	9	16,085	1,125,840,103	1,013,530,300	112,309,803	154,18
46	Consumers Power Company	8	(C) 264,000	38	(C) 140,130	1,016,384,395	913,207,527	103,176,868	160,32
47	Chicago District Electric Generating Corporation	1	200,000	0	0	1,009,506,000	1,009,506,000	0	
48	Ohio Edison Company	5	(C) 311,500	1	(C) 2,175	849,713,467	697,558,966	152,154,501	96,71
49	Illinois Power & Light Corporation (Illinois)	17	82,535	1	3,590	506,145,010	77,766,387	428,378,623	63,30
50	Indiana & Michigan Electric Company	2	93,500	4	22,004	491,439,695	335,028,955	156,410,740	29,37
51	Ohio Public Service Company	8	130,100	0	0	455,840,667	314,298,500	141,542,167	44,32
52	Toledo Edison Company	3	160,200	2	6,800	452,178,712	364,900,933	87,277,779	45,02
53	Central Indiana Power Company Subsidiaries	11	91,835	1	384	448,574,681	315,631,800	132,942,881	16,76
54	Northern Indiana Public Service Company	5	(L) 102,787	9	(L) 17,125	423,230,408	315,659,852	107,570,556	30,42
55	Indianapolis Power & Light Company	3	98,200	0	0	344,025,888	265,753,280	78,272,608	50,46
56	Central Illinois Public Service Company	8	84,375	0	0	342,162,436	190,513,610	151,648,826	46,58
57	Public Service Company of Indiana	11	(L) 67,285	2	(L) 4,270	320,594,122	113,137,800	207,456,322	35,49
58	Wisconsin Power & Light Company	9	54,924	36	37,663	284,597,748	164,480,922	120,116,826	30,19
59	Illinois Electric Power Company	2	79,400	0	0	272,384,736	268,187,336	4,197,400	
60	The Columbus Railway, Power & Light Company	2	132,500	0	0	270,864,584	270,864,584	0	49,24
61	City of Detroit, Public Lighting Commission	1	80,000	0	0	217,010,380	192,820,000	24,190,380	
62	Wisconsin Public Service Corporation and Subsidiary	3	39,750	9	29,620	185,877,236	181,122,075	4,755,161	18,02
63	City of Cleveland, Dept. of Public Utilities	1	50,000	0	0	179,870,560	179,870,560	0	24,21
64	Indiana Service Corporation	1	31,000	0	0	157,710,391	88,517,155	69,193,236	9,38
65	Central Illinois Light Company	0	0	0	0	151,421,136	0	151,421,136	21,00
66	Indiana General Service Company	3	40,950	0	0	147,896,790	3,114,968	144,781,822	15,64
67	Moline-Rock Island Manufacturing Company	2	78,200	0	0	130,452,095	91,377,358	39,074,737	
68	Wisconsin Valley Electric Company	2	3,250	9	15,592	126,791,351	58,985,928	67,805,423	10,91
	Totals for section	164	6,515,310	134	310,048	22,857,569,863	17,694,670,223	5,162,899,640	
	West North Central States								
69	The North American Co. Sys. (Mo., Ill. and Iowa Group)	8	462,670	2	264,000	1,868,194,882	1,868,177,038	17,844	185,17
70	Northern States Power Company (Del.) Subsidiaries	24	291,016	26	144,324	1,064,002,895	1,021,295,988	42,706,907	163,20
71	Kansas City Power & Light Company	(F) 3	(F) 237,911	0	0	629,935,369	627,276,082	2,659,287	74,20
72	Minnesota Power & Light Company	4	30,300	11	94,911	391,586,638	390,818,218	768,420	(k) 22,96
73	Nebraska Power Company	1	98,000	0	0	345,568,500	345,568,500	0	37,18
74	Kansas Gas & Electric Company	2	70,000	0	0	251,304,100	251,254,700	49,400	(k) 30,38
75	Des Moines Electric Light Company	3	91,940	1	800	185,041,631	185,041,631	0	25,27
76	Empire District Electric Company	(H) 2	(H) 67,600	4	19,600	178,540,162	176,678,900	1,861,262	8,00
77	Sioux City Gas & Elec. Co., Iowa Pub. Serv. Co. System	18	70,307	4	2,025	(I) 171,071,489	160,249,265	10,822,224	27,13
78	Kansas Power & Light Company	5	74,725	0	0	143,502,741	135,279,618	8,223,123	13,76
79	Interstate Power Company (Del.) and Subsidiaries	23	64,586	12	6,805	141,315,471			

Supplement to ELECTRICAL WORLD, May 7, 1932

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n Generator Rating, Output, Customers and Distribution of Energ
Having an Output Exceeding 100,000,000 Kw.-Hr. During 193

Distribution of Output in Kilowatt-Hours, 1931									Number of C			
Domestic Service (10)	Commercial, Small Light and Power (Retail) (11)	Commercial, Large Light and Power (Wholesale) (12)	Municipal Service (Street Lighting, etc.) (13)	Other Sales to Ultimate Consumers (14)	Electric Railway Operation (Including Company-Owned) (15)	Other Public Utilities (Including Municipal Systems) (16)	Used by Company (17)	Not Accounted for (Losses) (18)	Domestic (19)	Commercial Small Light and Power (Retail) (20)	Commercial Large Light and Power (Wholesale) (21)	M S (Li
77,750,164	132,193,616	624,557,739	41,458,433		85,814,301	605,320,762	48,824,906	271,407,651	409,853	61,405	12,299	
67,543,336	197,931,549	295,267,481	30,251,220		8,131,260	175,513,624	4,525,365	169,442,007	(a) 301,631	(a) 71,271	(a) 540	(a)
68,541,871	35,049,325	196,711,582	9,148,675		47,263,746	99,740,566	17,145,830	78,458,161	114,878	16,577	2,688	
40,469,000	30,431,000	144,178,000	9,783,000	(c) 19,065,000	26,260,000	94,873,000	6,870,000	71,071,000	72,921	11,792	2,904	
28,858,679	20,998,187	255,294,236	7,830,072		11,451,574	51,312,070	7,729,097	57,193,912	60,008	10,773	1,882	
0	0	0	0	0	0	435,364,000	0	(d)	0	0	0	
38,749,137	60,001,298	47,509,292	7,150,645	(f) 64,024,702	23,495,200	96,651,546	2,720,118	28,668,904	59,702	9,669	74	
52,623,106	53,026,655	129,618,932	7,966,839			4,828,500	3,363,639	26,634,329	103,072	14,534	3,652	
14,627,975	14,837,426	114,508,679	3,514,214	0	0	20,107,372	535,527	23,958,228	40,287	5,556	415	(g)
12,007,035	8,320,504	123,519,017	4,228,683			22,910,400	2,697,944	16,902,247	34,202	5,232	1,082	
18,417,100	13,207,522	53,864,165	5,560,150		8,898,082	55,449,462	6,201,450	20,351,617	43,544	7,406	1,788	
20,094,378	19,314,633	57,702,621	4,797,942	866,000	16,511,402	6,588,270	2,836,598	20,382,053	38,462	6,560	1,727	
11,813,193	6,574,555	23,622,436	1,763,793			82,791,917	914,365	5,479,757	(k) 18,367	(k) 3,026	(k) 977	(k)
13,652,748	(i, z)	(z) 66,809,011	1,444,084		3,352,586	3,858,148	273,518	17,160,481	(i) 24,423	(i, z)	(z) 4,115	
76,343,128	337,141,790	3,548,590,002	116,101,818		189,044,111	591,848,252	42,621,119	709,719,170	(k) 552,710	83,841	4,464	
616,600,000	(m)	1,923,000,000	203,300,000		268,000,000	375,100,000	(n)	(n) 752,200,000	1,604,028	396,737	16,588	
15,859,441	237,055,258	1,105,558,625	144,888,530	333,929	496,913,628	372,477,991	31,258,686	327,977,791	523,926	91,365	19,900	
17,324,258	9,186,344	1,244,411,531	67,941,103		198,626,824	2,701,460	19,732,552	310,588,528	(o) 865,126	(o)	(o)	
41,730,920	99,945,066	1,096,666,451	38,245,902		70,219,559	18,865,246		228,181,945	238,035	40,881	6,486	
29,506,971	129,379,933	819,856,504	45,513,784	7,060,179	85,231,918	86,166,135	6,241,765	174,220,058	279,755	51,640	4,597	
08,609,200	120,715,415	646,168,928	33,984,780		210,363,427	3,663,114	4,075,813	136,737,836	275,690	31,858	1,967	
59,216,742	45,051,916	314,735,357	12,155,617		31,434,812	156,586,727	(N) 7,068,235	80,101,902	119,564	21,588	3,829	
0	0	0	0	(r) 7,466,000	0	457,202,800		41,549,800	0	0	0	
66,388,579	35,322,015	167,840,747	18,159,379		7,447,578	72,633,823	2,801,328	59,415,925	121.672	19,439	4,331	
44,859,485	30,976,021	220,621,886	6,354,488		8,318,250	29,043,963	1,477,610	69,913,631	92,709	14,148	2,986	
56,493,266	74,941,949	106,162,045	29,715,811		32,801,269	2,015,228	16,326,577	47,825,295	106,472	12,695	988	
65,783,312	(o)	(o)	27,734,330			(u) 112,888,744	2,960,550	48,063,384	(h, v) 143,914	(v)	(v)	
27,320,411	(m)	5,548,192	8,202,339	17,517,067		246,748,198	765,603	11,564,453	(m) 37,388	(m)	60	
27,433,077	29,308,608	135,299,897	5,046,470		22,652,042	13,989,178	4,669,784	25,412,136	65,771	10,319	211	
66,463,165	31,807,620	55,402,288	30,903,753	327,970		1,476,698	6,570,654	51,203,915	119,442	16,248	6,971	
27,519,350	15,031,056	114,092,723	2,908,903		13,054,357	25,611,171	2,148,622	33,795,877	49,121	6,276	1,648	
27,121,270	28,498,944	52,299,355	10,616,515		1,085,370	67,639,672	4,187,169	30,392,557	49,743	12,744	96	
33,635,280	29,696,219	98,329,486	11,460,399		993,831	1,307,280	1,777,745	36,619,654	68,581	13,593	2,596	
36,564,750	(z)	(y) 74,142,009	19,854,880	(A) 5,381,607	7,865,157	5,989,756	3,641,621	39,146,912	66,796	(z)	(z) 12,548	
19,550,283	17,476,986	111,380,406	3,167,169		4,199,128	8,509,924	666,366	13,126,096	34,249	5,516	100	
18,883,538	10,009,135	44,028,085	9,866,492		25,417,085	5,463,600	1,041,306	13,745,089	36,622	5,040	823	
12,812,645	6,276,786	74,439,226	2,922,785		10,948,164	833,381	1,320,179	13,663,275	30,879	2,841	846	
60,581,000	507,324,000	1,491,641,000	114,922,000	192,000	852,295,000	202,402,000	21,155,000	475,745,000	(B) 789,738	127,749	3,218	
36,841,844	463,742,282	853,839,776	73,425,350		77,540,068	83,565,180	30,807,300	250,492,800	(k) 465,487	81,122	447	
80,628,249	97,041,739	437,972,563	15,831,861	22,445,791	9,625,910	673,689,913	5,419,579	113,596,756	161,544	31,660	386	
42,314,732	92,423,650	305,482,039	86,339,952	6,992,205	85,332,218	439,620,084	17,961,526	185,471,650	243,681	37,147	624	
86,187,751	162,785,044	532,800,603	21,273,218	6,074,555	147,999,356	98,533,162	5,687,375	154,774,963	267,974	34,655	635	
0	0	0	0	0	0	1,253,830,208	0	0	0	0	0	
54,195,474	106,841,213	494,502,723	41,190,402	0	112,187,129	109,755,482	17,085,640	126,650,957	267,621	38,656	8,435	
54,180,542	130,528,887	469,697,629	13,099,855	956,805	126,201,786	65,019,773	12,147,733	154,007,093	255,966	42,108	4,754	
60,321,097	183,039,169	396,749,941	24,413,434		28,064,716	21,551 836	12,440,217	189,803,985	257,572	49,468	596	
0	0	0	0	0	0	1,009,506,000	0	0	0	0	0	
96,715,592	120,217,066	251,506,037	13,871,587		54,809,472	218,728,187	3,445,119	90,420,407	148,537	21,443	320	
63,308,679	53,776,799	210,996,348	18,799,469	(A) 3,101,136	47,745,029	5,544,732	10,556,252	92,316,566	150.690	27,043	5,926	
29,373,657	29,661,422	80,706,942	4,481,730		12,359,826	298,530,620	1,724,476	34,601,022	52,608	8,656	330	
44,327,623	34,315,757	238,737,312	7,271,437		2,691,900	80,199,567	2,148,496	46,148,575	67,564	9,871	1,855	
45,021,385	49,719,918	201,750,701	10,119,999		36,965,998	42,893,887	2,978,380	62,728,444	82,198	10,912	1,852	
16,764,972	13,623,324	64,601,742	3,651,299	2,643,840	59,536,470	223,069,059	6,164,039	58,519,936	41,985	8,717	1,947	
30,426,097	23,060,362	182,771,952	6,858,072	5,727,387	33,100,703	66,864,022	6,637,045	67,784,768	59,772	11,217	2,487	
50,465,370	92,419,451	123,385,664	18,090,434			10,347,172	1,319,918	47,997,879	94.544	12.554	238	
46,586,890	49,918.407	100,154,038	19,627,467	(A) 4,856,926	797,460	38,529,645	16,218,225	65,473,378	117.968	28,256	185	
35,495,444	28,874,745	147,144,309	8,620,220	4,844,751	5,142,704	19,391,474	18,754,782	52,325,693	94.248	17,386	4,172	
30,195,887	22,613,510	44,792,312	7,221,437	(A) 6,469,251	2,593,869	113,027,151	12,159,157	45,525,174	66,949	12.588	3,950	
0	0	0	0	0	0	265,731,123		6,653,613	0	0	0	
49,242,391	43,087,609	90,715,231	2,787,041	295,309	27,315,964	27,371,430	1,713,804	28,335,805	83,216	9,879	848	
0	104,369	17,396,623	91,901,146	0	94,562,710	0		13,045,532	0	13	5	
18,025,722	15,201,126	64,228,184	5,151,436		2,399,100	52,317,622	1,736,687	26,817,359	35,822	7,068	1,699	
24,218,288	78,551,264	1,134,912	39,329,815				15,288,860	21,347,421	37.949	6,874	1	
9,383,105	13,944,475	70,855,621	538,252	2,042,917	5,013,619	21,524,113	23,232,583	11,175,706	17,564	3,174	1,271	
21,005,327	30,051,764	77,982,359	4,877,805		228,230	3,872,425	176,767	13,226,459	34,965	7,164	160	
15,648,196	20,645,410	85,411,099	4,061,725		220	1,510,073	1,287,507	19,332,560	30,829	4.823	98	
0	0	0	0	8,480	19,873,789	108,134,050	7,776	2,428,000	0	0	0	
10,914.355	8,579,179	80,854,416	2,798,534		2,061,390	7,758,600	720,089	13,104,788	21,284	4,092	1,057	
85,179,106	268,808,599	699,903,332	42,511,469		161,982,229	304,877,925	7,840,997	197,091,225	276,100	41,624	333	
63,201,551	163,156,093	391,963,504	83,741,506		3,572,981	72,276,901	10,733,881	175,356,478	292,400	50,506	21,154	
74,202,245	136,781,874	196,824,835	32,877,556		99,135,872	25,685,574	302,787	64,124,626	106,764	26,177	140	
22,967,725	34,012,023	199,706,829	3,192,104		13,136,690	51,768,099	1,609,640	65,193,528	(k) 36,394	6,740	387	
37,182,146	65,654,739	124,073,670	7,612,090	(G) 1,415,703	28,181,800	53,213,438		28,234,914	56,783	8,259	216	
30,389,337	42,759,858	119,294,942	2,731,705		5,381,979	13,242,406	778,959	36,724,914	(k) 51,267	8,234	642	
25,270,422	12,347,350	79,503,651	8,814,084	(A) 1,075,241		31,720,154	954,693	25,356,036	44,671	5,735	2,161	
8,001,838	9,758,791	74,071,769	1,636,772		4,751,300	42,582,825	861,179	36,875,688	19,227	5,025	1,406	
27,133,811	23,609,587	59,101,202	11,718,000	(J) 5,387,964	4,000,185	7,814,315	4,655,443	27,650,982	59,675	11,672	3,734	
13,764,076	15,846,785	26,947,528	3,737,762	(A) 820,679	1,561,749	61,282,832	1,223,764	18,317,566	26,770	5,324	838	

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Table II—Detailed Data on Generator Rating, Output, Customers a of Public Utility Systems Having an Output Exceeding 100,000,0

| | | |

s and Distribution of Energy
0,000 Kw.-Hr. During 1931

This tabulation is based on the operating company as the unit. Group statistics are given in a few instances for properties which, though distinct corporate entities, are so interconnected and operated as to constitute in each case a single physical system.

Used by Company (17)	Not Accounted for (Losses) (18)	Number of Customers, Dec. 31, 1931: Domestic (19)	Commercial Small Light and Power (Retail) (20)	Commercial Large Light and Power (Wholesale) (21)	Municipal Service (Street Lighting, etc.) (22)	Other Sales to Ultimate Consumers (23)	Electric Railway Operation (24)	Other Public Utilities (Including Municipal Systems) (25)	Line No. (26)
48,824,906	271,407,651	409,853	61,405	12,299	159	.....	9	112	1
4,525,365	169,442,007	(a) 301,631	(a) 71,271	(a) 540	(a) 40	.....	(a) 2	(a) 11	2
17,145,830	78,458,161	114,878	16,577	2,688	80	.....	3	16	3
6,870,000	71,071,000	72,921	11,792	2,904	42	(c) 1	4	15	4
7,729,097	57,193,912	60,008	10,773	1,882	940	.....	5	11	5
0	(d)	0	0	0	0	0	0	4	6
2,720,118	28,668,904	59,702	9,669	74	28	(f) (3)	1	5	7
3,363,639	26,634,329	103,072	14,534	3,652	.....	.....	.....	.....	8
535,527	23,958,228	40,287	5,556	415	(g) 233	0	0	(g)	9
2,697,944	16,902,247	34,202	5,232	1,082	247	.....	.....	1	10
6,201,450	20,351,617	43,544	7,406	1,788	477	.....	4	23	11
2,836,598	20,382,053	38,462	6,560	1,727	351	1	1	.....	12
914,365	5,479,757	(h) 18,367	(h) 3,026	(h) 977	(h) 14	.....	.....	(h) 6	13
273,518	17,160,481	(i) 24,423	(i, z)	(z) 4,115	61	.....	1	6	14
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
42,621,119	709,719,170	(k) 552,710	83,841	4,464	875	.....	21	78	15
(n)	(n) 752,200,000	1,604,028	396,737	16,588	1,526	.....	7	3	16
31,258,686	327,977,791	523,926	91,365	19,900	940	289	12	19	17
19,732,552	310,588,528	(o) 865,126	(o)	(o)	216	.....	6	4	18
.....	228,181,945	238,035	40,881	6,486	2,406	.....	60	29	19
6,241,765	174,220,058	279,755	51,640	4,597	2,702	8,945	20	29	20
4,075,813	136,737,836	275,690	31,858	1,967	161	.....	1	3	21
(N) 7,068,235	80,101,902	119,564	21,588	3,829	734	.....	6	12	22
.....	41,549,800	0	0	0	0	(r)	0	.....	23
2,801,328	59,415,925	121,672	19,439	4,331	1,049	.....	3	37	24
1,477,610	69,913,631	92,709	14,148	2,986	835	.....	3	13	25
16,326,577	47,825,295	106,472	12,695	988	920	.....	8	7	26
2,960,550	48,063,384	(h, v) 143,914	(v)	(v)	(v)	.....	.....	(v)	27
765,603	11,564,453	(m) 37,388	(m)	60	4	15	.....	.....	28
4,669,784	25,412,136	65,771	10,319	211	440	.....	2	4	29
6,570,654	51,203,915	119,442	16,248	6,971	613	.....	.....	2	30
2,148,622	33,795,877	49,121	6,276	1,648	80	.....	2	12	31
4,187,169	30,392,557	49,743	12,744	96	220	.....	1	10	32
1,777,745	36,619,654	68,581	13,593	2,596	166	.....	2	1	33
3,641,621	39,146,912	66,796	(z)	(z) 12,548	763	(A) 8.264	1	10	34
666,366	13,126,096	34,249	5,516	100	.....	.....	3	4	35
1,041,306	13,745,089	36,622	5,040	823	189	.....	2	1	36
1,320,179	13,663,275	30,879	2,841	846	157	.....	2	2	37
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
21,155,000	475,745,000	(B) 789,738	127,749	3,218	4	59	5	.....	38
30,807,300	250,492,800	(k) 465,487	81,122	447	183	.....	4	2	39
5,419,579	113,596,756	161,544	31,660	386	182	1,381	7	58	40
17,961,526	185,471,650	243,681	37,147	624	2,310	9,351	9	11	41
5,687,375	154,774,963	267,974	34,655	635	117	315	3	5	42
0	0	0	0	0	0	0	0	.....	43
17,085,640	126,650,957	267,621	38,656	8,435	549	0	16	14	44
12,147,733	154,007,093	255,966	42,108	4,754	271	214	.....	20	45
12,440,217	189,803,985	257,572	49,468	596	270	.....	4	10	46
0	0	0	0	0	0	0	0	2	47
3,445,119	90,420,407	148,537	21,443	320	68	.....	11	22	48
10,556,252	92,316,566	150,690	27,043	5,926	376	(A) 3,506	.....	22	49
1,724,476	34,601,022	52,608	8,656	330	32	.....	4	14	50
2,148,496	46,148,575	67,564	9,871	1,855	28	.....	(E)	13	51
2,978,380	62,728,444	82,198	10,912	1,852	24	.....	7	12	52
6,164,039	58,519,936	41,985	8,717	1,947	136	3,541	4	63	53
6,637,045	67,784,768	59,772	11,217	2,487	239	3,138	3	23	54
1,319,918	47,997,879	94,544	12,554	238	8	.....	.....	2	55
16,218,225	65,473,378	117,968	28,256	185	1,753	(A) 6,944	1	14	56
18,754,782	52,325,693	94,248	17,386	4,172	247	2,987	11	52	57
12,159,157	45,525,174	66,949	12,588	3,950	188	(A) 9,033	0	50	58
.....	6,653,613	0	0	0	0	0	0	3	59
1,713,804	28,335,805	83,216	9,879	848	185	.....	1	5	60
.....	13,045,532	0	13	5	.....	0	.....	0	61
1,736,687	26,817,359	35,822	7,068	1,699	66	.....	(E)	9	62
15,288,860	21,347,421	37,949	6,874	1	143	.....	.....	.....	63
23,232,583	11,175,706	17,564	3,174	1,271	39	3,682	2	7	64
176,767	13,226,459	34,965	7,164	160	25	.....	1	4	65
1,287,507	19,332,560	30,829	4,823	98	19	.....	.....	4	66
7,776	2,428,000	0	0	0	0	1	3	2	67
720,089	13,104,788	21,284	4,092	1,057	96	.....	(E)	8	68
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
7,840,997	197,091,225	276,100	41,624	333	39	.....	3	21	69
10,733,881	175,356,478	292,400	50,506	21,154	720	.....	2	77	70
302,787	64,124,626	106,764	26,177	140	386	.....	2	9	71
1,609,640	65,193,528	(k) 36,394	6,740	387	67	.....	1	22	72
.....	28,234,914	56,783	8,259	216	39	(G) 1,095	1	2	73
778,959	36,724,914	(k) 51,267	8,234	642	44	.....	7	19	74
954,693	25,356,036	44,671	5,735	2,161	216	(A) 1,396	.....	4	75
861,179	36,875,688	19,227	5,025	1,406	52	.....	2	9	76
4,655,443	27,650,982	59,675	11,672	3,734	167	(J) 4,835	1	34	77
1,223,764	18,317,566	26,770	5,324	838	152	(A) 795	.....	15	78

(a) Bills rendered in December.

(b) Gross.

(c) Electricity exchanged for water power

(d) All energy sold at low-tension bus of generating station.

(e) Includes exchange 40,367,121 kw.-hr.

(f) Exchange.

(g) Other public utilities (including municipal systems) combined with municipal service (street lighting, etc.).

(h) Customers' meters.

(i) Commercial light combined with domestic service.

(j) Canadian Niagara Power Co., Ltd (see Canada), included in Niagara Hudson Power Corp. system; also St. Lawrence Power Co., Ltd., one hydro plant, 2,000 kw., generated 12,640,297 kw.-hr. (Canada).

(k) Includes farm service.

(l) Includes New York Edison Co., Brooklyn Edison Co., Inc., New York & Queens Electric Light & Power Co., and United Electric Light & Power Co.

(m) Commercial, small light and power (retail) combined with domestic service.

(n) Energy used by company included with losses.

(o) Commercial, small light and power (retail) and commercial, large light and power (wholesale) combined with domestic service.

(p) Also one plant, 5,000 kw., operated by purchased steam.

(q) Chiefly Metropolitan Edison Co., and New Jersey Power & Light Co.

(r) Energy sold to Arundel Corp. at Safe Harbor, Pa., for construction.

(s) Chiefly Pennsylvania Electric Co., Erie Lighting Co., Clarion River Power Co. and Youghiogheny Hydro-Electric Corp.

(t) Kw.-hr. transferred from associated companies.

(u) Includes 110,945,531 kw.-hr. transferred to associated companies.

(v) Customers of all classes included under domestic.

(w) Includes company's share of jointly owned plant (Stanton).

(x) Includes company's share of jointly owned plant (Deepwater).

(y) Includes 86,945,790 kw.-hr. economy flow to other companies.

(z) Retail combined with wholesale.

(A) Rural service.

(B) Includes 35,853 hall light customers.

(C) Additional capacity is available by contract, or by lease and contract, as follows:

Co. No.	Kw.
46	19,560
48	20,000
83	26,278
94	2,000
97	230,700
105	3,673

(D) Includes company's share of jointly owned plant (Windsor).

(E) Company-owned.

(F) Includes one plant, 186 kw., internal combustion.

(G) Farm service.

,887	22,613,510	44,792,312	7,221,437	(A) 6,469,251	2,593,869	113,027,151	12,159,157	45,525,174	66,949	12.588	3,950
0	0	0	0	0	0	265,731,123	.....	6,653,613	0	0	0
,391	43,087,609	90,715,231	2,787,041	295,309	27,315,964	27,371,430	1,713,804	28,335,805	83,216	9,879	848
0	104,369	17,396,623	91,901,146	0	94,562,719	0	.....	13,045,532	0	13	5

800	185,041,631	185,041,631	0	25,270,422	12,347,350	79,503,651	8,814,084	(A)	1,075,241	.....	31,720,154	
19,600	178,540,162	176,678,900	1,861,262	8,001,838	9,758,791	74,071,769	1,636,772	.....		4,751,300	42,582,825	
2,025	(I) 171,071,489	160,249,265	10,822,224	27,133,811	23,609,587	59,101,202	11,718,000	(J)	5,387,964	4,000,185	7,814,315	

	[illegible]			9	54,924	36	37,663	284,597,748	164,480,922	120,116,826	30,195,88	
59	Illinois Electric Power Company			2	79,400	0	0	272,384,736	268,187,336	4,197,400		
60	The Columbus Railway, Power & Light Company			2	132,500	0	0	270,864,584	270,864,584	0	49,242,39	
61	City of Detroit, Public Lighting Commission			1	80,000	0	0	217,010,380	192,820,000	24,190,380		
62	Wisconsin Public Service Corporation and Subsidiary			3	39,750	9	29,620	185,877,236	181,122,075	4,755,161	18,025,72	
63	City of Cleveland, Dept. of Public Utilities			1	50,000	0	0	179,870,560	179,870,560	0	24,218,28	
64	Indiana Service Corporation			1	31,000	0	0	157,710,391	88,517,155	69,193,236	9,383,10	
65	Central Illinois Light Company			0	0	0	0	151,421,136	0	151,421,136	21,005,32	
66	Indiana General Service Company			3	40,950	0	0	147,896,790	3,114,968	144,781,822	15,648,19	
67	Moline-Rock Island Manufacturing Company			2	78,200	0	0	130,452,095	91,377,358	39,074,737		
68	Wisconsin Valley Electric Company			2	3,250	9	15,592	126,791,351	58,985,928	67,805,423	10,914,35	
	Totals for section			164	6,515,310	134	310,048	22,857,569,863	17,694,670,223	5,162,899,640	.....	
	West North Central States											
69	The North American Co. Sys. (Mo., Ill. and Iowa Group)			8	462,670	2	264,000	1,868,194,882	1,868,177,038	17,844	185,179,10	
70	Northern States Power Company (Del.) Subsidiaries			24	291,016	26	144,324	1,064,002,895	1,021,295,988	42,706,907	163,201,55	
71	Kansas City Power & Light Company		(F)	3	(F) 237,911	0	0	629,935,369	627,276,082	2,659,287	74,202,24	
72	Minnesota Power & Light Company			4	30,300	11	94,911	391,586,638	390,818,218	768,420	(k) 22,967,72	
73	Nebraska Power Company			1	98,000	0	0	345,568,500	345,568,500	0	37,182,14	
74	Kansas Gas & Electric Company			2	70,000	0	0	251,304,100	251,254,700	49,400	(k) 30,389,33	
75	Des Moines Electric Light Company			3	91,940	1	800	185,041,631	185,041,631	0	25,270,42	
76	Empire District Electric Company		(H)	2	(H) 67,600	4	19,600	178,540,162	176,678,900	1,861,262	8,001,83	
77	Sioux City Gas & Elec. Co., Iowa Pub. Serv. Co. System			18	70,307	4	2,025	(I) 171,071,489	160,249,265	10,822,224	27,133,81	
78	Kansas Power & Light Company			5	74,725	0	0	143,502,741	135,279,618	8,223,123	13,764,07	
79	Interstate Power Company (Del.) and Subsidiaries			23	64,586	12	6,805	141,315,424	103,925,786	37,389,638	27,230,02	
80	Iowa Railway & Light Corporation			8	59,095	2	1,760	134,821,422	134,381,352	440,070	18,490,00	
81	United Power & Light Corporation (of Kansas)			11	44,335	5	3,895	127,308,532	122,345,539	4,962,993	15,105,30	
	Totals for section			112	1,662,485	67	538,120	5,632,193,785	5,522,292,617	109,901,168	.....	
	South Atlantic States											
82	Duke Power Company		(L)	8	(L) 306,650	40	(L) 597,205	1,768,184,411	1,461,676,952	306,507,459	(K)	
83	Georgia Power Company		(C)	18	(C) 90,531	27	(C) 290,443	1,319,011,309	872,961,970	446,049,339	88,180,20	
84	Appalachian Electric Power Company (O)			10	340,440	5	44,900	1,276,642,108	1,197,363,345	79,278,763	57,621,82	
85	Consolidated Gas, Elec. Lt. & Pwr. Co. of Baltimore			3	257,000	1	600	884,250,577	610,681,264	273,569,313	136,921,75	
86	Carolina Power & Light Company			4	46,750	12	206,300	731,648,290	521,459,820	210,188,470	32,529,62	
87	Virginia Electric & Power Company			10	132,710	9	28,050	534,628,983	407,405,365	127,223,618	55,323,06	
88	The North American Co. Sys. (Dist. of Columbia Group)			1	208,000	0	0	519,295,192	519,295,192	0	91,974,33	
89	Assoc. Gas & Elec. System (South Carolina Group) (Q)			2	78,000	4	154,705	425,907,556	415,962,105	9,945,451	6,169,64	
90	Virginia Public Service Company		(L)	4	(L) 66,950	12	(L) 14,536	220,893,275	206,937,994	13,955,281	(R) 42,551,28	
91	Florida Power & Light Company			40	139,840	0	0	208,124,600	205,661,000	2,463,600	46,207,14	
92	Tampa Electric Company			3	36,625	1	600	143,522,953	132,078,250	11,444,703	13,163,71	
93	Delaware Power & Light Company			0	0	0	0	136,633,985	0	136,633,985	16,061,15	
94	South Carolina Power Company		(C)	6	(C) 20,032	2	(C) 16,275	130,897,921	114,762,550	16,135,371	9,137,17	
95	Florida Power Corporation and Subsidiaries			10	45,224	2	13,800	109,489,363	107,484,163	2,005,200	10,496,55	
96	Wheeling Electric Company			2	9,360	0	0	100,652,334	0	100,652,334	13,848,56	
	Totals for Section			121	1,778,112	115	1,367,414	8,509,782,857	6,773,729,970	1,736,052,887	.....	
	East South Central States											
97	Alabama Power Company		(C)	14	(C) 156,603	6	(C) 398,300	1,860,805,943	1,421,009,577	439,796,366	62,243,55	
98	The Tennessee Electric Power Company		(L)	16	(L) 109,370	15	(L) 133,243	762,528,751	553,931,181	208,597,570	52,831,00	
99	Louisville Gas & Electric Company (Del.) Subsidiaries			3	112,020	1	80,320	450,407,520	420,086,580	30,320,940	41,931,33	
100	U. S. Government (Muscle Shoals)			0	0	1	184,000	345,603,400	345,603,400	0	0	
101	Birmingham Electric Company			1	11,700	0	0	252,222,842	0	252,222,842	26,095,74	
102	Kentucky Utilities Company		(V)	17	54,372	2	24,540	249,540,548	208,038,390	41,502,158	16,904,33	
103	Memphis Power & Light Company			1	54,000	0	0	189,341,440	187,566,400	1,775,040	22,585,25	
104	Mississippi Power & Light Company			47	20,488	0	0	146,433,090	5,135,431	141,297,659	16,276,05	
105	Mississippi Power Company		(C)	26	(C) 25,572	0	0	118,526,461	19,990,426	98,536,035	16,992,77	
106	Tennessee Public Service Company			3	6,405	1	150	112,918,808	374,000	112,544,808	12,271,33	
	Totals for section			128	550,530	26	820,553	4,488,328,803	3,161,735,385	1,326,593,418	.....	
	West South Central States											
107	Louisiana Power & Light Company			15	90,122	0	0	612,119,000	537,880,000	74,239,000	8,572,16	
108	Houston Lighting & Power Company			7	175,681	0	0	524,913,000	501,423,000	23,490,000	40,760,00	
109	Texas Electric Service Company		(L)	12	(L) 101,766	0	0	521,669,355	509,195,355	12,474,000	32,481,61	
110	Oklahoma Gas & Electric Company			17	188,112	0	0	489,174,640	464,045,390	25,129,250	47,729,52	
111	Texas Power & Light Company		(L)	15	(L) 99,254	4	885	445,325,000	317,060,000	128,265,000	40,204,65	
112	New Orleans Public Service Inc.			1	108,000	0	0	341,034,400	341,034,400	0	32,211,07	
113	Arkansas Power & Light Company		(L)	44	(L) 41,506	3	(L,S) 37,666	304,690,000	49,454,000	255,236,000	21,156,09	
114	Gulf States Utilities Company			15	80,008	0	0	266,182,789	132,076,485	134,106,304	17,894,06	
115	Central Power & Light Company		(U)	11	(U) 53,666	4	5,400	249,425,222	223,747,139	25,678,083	20,846,77	
116	Dallas Power & Light Company			1	82,500	0	0	220,291,750	217,805,500	2,486,250	32,325,85	
117	West Texas Utilities Company			22	53,990	0	0	203,968,162	199,233,218	4,734,944	18,435,11	
118	Public Service Company of Oklahoma			14	79,320	0	0	200,698,570	168,467,323	32,231,247	26,472,69	
119	San Antonio Public Service Company			4	98,250	3	1,590	199,783,901	155,656,570	44,127,331	23,460,13	
120	Southwestern Gas & Electric Company			15	45,850	0	0	196,644,219	153,086,164	43,558,055	19,743,39	
121	El Paso Electric Company (and Affiliates)			5	60,308	0	0	110,485,989	110,485,989	0	9,594,71	
	Totals for section			198	1,358,333	14	45,541	4,886,405,997	4,080,650,533	805,755,464	.....	
	Mountain States											
122	The Montana Power Company			2	900	11	293,400	937,014,000	933,669,000	3,345,000	37,087,59	
123	Utah Power & Light Company		(L)	5	(L) 42,740	37	(L) 182,472	650,549,000	431,559,000	218,990,000	63,009,57	
124	Idaho Power Company			0	0	8	71,500	450,864,575	426,172,842	24,691,733	31,872,53	
125	Public Service Company of Colorado		(X)	14	(L,X) 89,200	10	(L) 33,900	318,427,572	315,270,408	3,157,164	46,670,88	
126	Salt River Valley Water Users' Association			0	0	8	70,050	292,324,270	231,056,685	61,267,585	(A) 5,766,67	
	Totals for section			21	132,840	74	651,322	2,649,179,417	2,337,727,935	311,451,482	.....	
	Pacific States											
127	Pacific Gas & Electric Company and all Subsidiaries		(L)	15	(L) 380,600	50	(L) 879,144	4,558,552,038	3,997,825,977	560,726,061	445,949,76	
128	Southern California Edison Company, Ltd.		(L)	5	(L) 461,600	24	(L) 490,140	3,061,836,977	3,044,636,122	17,200,855	260,392,93	
129	Puget Sound Power & Light Company			7	112,000	14	150,735	911,955,295	819,618,077	92,337,218	123,789,03	
130	The Washington Water Power Company			1	150	12	206,234	784,134,417	772,523,090	11,611,327	86,073,30	
131	City of Los Angeles, Dept. of Water and Power			0	0	5	96,605	759,028,656	277,123,000	481,905,656	.....	
132	Portland General Electric Company			3	88,000	6	107,480	603,182,100	594,132,200	9,049,900	89,788,68	
133	The California Oregon Power Company		(L)	3	(L) 15,410	11	92,880	465,156,805	380,796,014	84,360,791	36,294,16	
134	Los Angeles Gas & Electric Corporation			2	148,700	0	0	429,006,384	428,994,952	11,432	(i) 183,652,89	
135	City of Seattle, Dept. of Lighting			1	30,000	4	97,500	353,764,500	350,457,900	3,306,600	90,619,62	
136	Hetch Hetchy Water Supply, City & County of San Francisco			0	0	2	83,600	309,450,010	309,449,010	1,000		
137	Northwestern Electric Company			2	42,500	1	9,600	287,290,707	188,273,471	99,017,236	38,655,45	
138	The Nevada-California Electric Corporation System (dd)			3	8,257	11	58,575	(b) 275,500,157	(b) 164,460,987	111,039,170	(ee) 7,887,72	
139	City of Tacoma, Dept. Public Utilities, Light Division			1	9,000	3	139,000	253,913,000	252,284,000	1,629,000	42,548,68	
140	Pacific Power & Light Company		(L)	4	(L) 11,150	10	(L) 22,642	230,487,553	134,196,449	96,291,104	(k) 64,190,22	
141	San Diego Consolidated Gas & Electric Company			2	74,000	0	0	198,800,090	195,898,100	2,901,990	34,245,02	
142	Mountain States Power Company			21	31,345	7	6,110	127,099,816	32,113,720	94,986,096	32,076,00	
	Totals for section			70	1,412,712	160	2,440,245	13,609,158,505	11,942,783,069	1,666,375,436	.....	
	Canada											
143	Hydro-Electric Power Commission of Ontario			1	18,000	39	943,150	4,387,316,157	3,223,006,488	1,164,309,669	.....	
144	The Shawinigan Water & Power Company			0	0	8	(hh) 604,800	(hh) 3,436,436,460	(hh) 2,864,915,469	571,520,991	13,096,34	
145	Canadian Hydro-Electric Corporation, Ltd. System			1	6,750	18	506,014	2,414,375,792	2,412,322,542	2,053,250	(m) 28,858,23	
146	Montreal Light, Heat & Power Consolidated			1	16,500	4	215,410	1,557,929,949	763,929,381	794,000,568	120,782,72	
147	Duke-Price Power Company, Ltd.			0	0	1	363,000	1,518,632,376	1,518,632,376	0	.....	
148	Winnipeg Electric Company (ii)			1	12,000	3	235,375	614,665,600	614,665,600	0	71,807,77	
149	West Kootenay Power & Light Company, Ltd.			0	0	3	123,000	591,772,849	591,772,849	0	5,573,70	
150	Canadian Niagara Power Company, Ltd.			0	0	1	75,000	490,148,000	490,148,000	.....	.....	
151	British Columbia Electric Railway Company, Ltd. (jj)		(kk)	1	(kk) 17,500	6	(kk) 167,335	(jj) 425,510,139	425,510,139	0	69,530,50	
152	Canada Northern Power Corporation, Ltd. System			0	0	9	94,375	418,226,810	418,226,810	0	8,507,85	
153	City of Winnipeg Hydro-Electric System		(ll)	1	(ll) 11,190	2	(L) 96,234	412,080,147	346,100,772	65,979,375	166,820,04	
154	Calgary Power Company, Ltd.			6	(L) 17,849	4	(L) 52,100	188,668,281	184,817,474	3,850,807	2,714,59	
155	The Nova Scotia Power Commission			0	0	12	(oo) 62,630	173,924,966	173,924,966	0	173,29	
156	Southern Canada Power Company, Ltd.			0	0	5	43,875	159,873,880	142,910,400	16,963,480	11,527,50	
157	Montreal Island Power Company			0	0	1	45,000	146,048,890	146,048,890	0		
	Totals for Canada			12	96,289	116	3,572,955	16,935,610,296	14,316,932,156	2,618,678,140	.....	
	Mexico											
158	The Mexican Light & Power Company, Ltd.			2	32,250	14	178,498	[illegible]	6,469,25[illegible]	2,593,869	[illegible]	

0	272,384,726	268,187,336	4,197,400	0	0	0	0	0	0	265,731,123	.....	
0	270,864,584	270,864,584	0	49,242,391	43,087,609	90,715,231	2,787,041	295,309	27,315,964	27,371,430	.....	

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157	Montreal Island Power Company	0	0	1	45,000	146,048,890	146,048,890				0			
	Totals for Canada	12	96,289	116	3,572,955	16,935,610,296	14,316,932,156	2,618,678,140						
	Mexico													
32,158	The Mexican Light & Power Company, Ltd.	2	32,250	14	72,170,498	(g)21,150,100	6,469,251	2,593,869	115,027,191					
0	272,384,736	268,187,336	4,197,400	0	0	0	0	0	265,731,123					
0	270,864,584	270,864,584	0	49,242,391	43,087,609	90,715,231	2,787,041	295,309	27,315,964	27,371,430				
0	217,010,380	192,820,000	24,190,380	0	104,369	17,396,623	91,901,146	0	94,562,710	0				
29,620	185,877,236	181,122,075	4,755,161	18,025,722	15,201,126	64,228,184	5,151,436		2,399,100	52,317,622				
0	179,870,560	179,870,560	0	24,218,288	78,551,264	1,134,912	39,329,815							
0	157,710,391	88,517,155	69,193,236	9,383,105	13,944,475	70,855,621	538,252	2,042,917	5,013,619	21,524,113				
0	151,421,136	0	151,421,136	21,005,327	30,051,764	77,982,359	4,877,805		228,230	3,872,425				
0	147,896,790	3,114,968	144,781,822	15,648,196	20,645,410	85,411,099	4,061,725		220	1,510,073				
0	130,452,095	91,377,358	39,074,737	0	0	0	0	8,480	19,873,789	108,134,050				
15,592	126,791,351	58,985,928	67,805,423	10,914,355	8,579,179	80,854,416	2,798,534		2,061,390	7,758,600				
310,048	22,857,569,863	17,694,670,223	5,162,899,640											
264,000	1,868,194,882	1,868,177,038	17,844	185,179,106	268,808,599	699,903,332	42,511,469		161,982,229	304,877,925				
144,324	1,064,002,895	1,021,295,988	42,706,907	163,201,551	163,156,093	391,963,504	83,741,506		3,572,981	72,276,901				
0	629,935,369	627,276,082	2,659,287	74,202,245	136,781,874	196,824,835	32,877,556		99,135,872	25,685,574				
94,911	391,586,638	390,818,218	768,420	(k) 22,967,725	34,012,023	199,706,829	3,192,104		13,136,690	51,768,099				
0	345,568,500	345,568,500	0	37,182,146	65,654,739	124,073,670	7,612,090	(G) 1,415,703	28,181,800	53,213,438				
0	251,304,100	251,254,700	49,400	(k) 30,389,337	42,759,858	119,294,942	2,731,705		5,381,979	13,242,406				
800	185,041,631	185,041,631	0	25,270,422	12,347,350	79,503,651	8,814,084	(A) 1,075,241		31,720,154				
19,600	178,540,162	176,678,900	1,861,262	8,001,838	9,758,791	74,071,769	1,636,772		4,751,300	42,582,825				
2,025	(I) 171,071,489	160,249,265	10,822,224	27,133,811	23,609,587	59,101,202	11,718,000	(J) 5,387,964	4,000,185	7,814,315				
0	143,502,741	135,279,618	8,223,123	13,764,076	15,846,785	26,947,528	3,737,762	(A) 820,679	1,561,749	61,282,832				
6,805	141,315,424	103,925,786	37,389,638	27,230,029	19,120,755	31,537,066	10,234,309		2,794,353	21,311,264				
1,760	134,821,422	134,381,352	440,070	18,490,000	45,687,794	20,784,631	2,573,836	(A) 1,904,123	6,352,755	19,958,916				
3,895	127,308,532	122,345,539	4,962,993	15,105,308	12,126,764	52,476,789	2,599,241	(A) 1,049,602	351,400	16,258,059				
538,120	5,632,193,785	5,522,292,617	109,901,168											
(L) 597,205	1,768,184,411	1,461,676,952	306,507,459	(K)	(K)	1,414,430,124	(K)	(K)	(K)	(M) 57,080				
(C) 290,443	1,319,011,309	872,961,970	446,049,339	88,180,205	150,492,790	592,355,191	17,726,829		57,493,911	147,210,077	(N)			
44,900	1,276,642,108	1,197,363,345	79,278,763	57,621,823	88,257,881	940,965,863	6,123,883	2,706,494	24,818,607	15,778,725				
600	884,250,577	610,681,264	273,569,313	136,921,757	96,537,895	390,193,556	24,206,390		135,776,326					
206,300	731,648,290	521,459,820	210,188,470	32,529,628	27,642,875	222,371,125	(P) 33,808,738	0	5,000,900	(P)273,269,228				
28,050	534,628,983	407,405,365	127,223,618	55,323,060	90,382,964	240,728,602	11,726,441	(G) 2,648,883	4,363,270	19,064,600				
0	519,295,192	519,295,192	0	91,974,333	122,650,718	115,683,080	21,073,322		73,056,303	553,020				
154,705	425,907,556	415,962,105	9,945,451	6,169,641	6,685,620	82,387,233	3,333,081		802,276	292,074,052	(N)			
(L) 14,536	220,893,275	206,937,994	13,955,281	(R) 42,551,282	21,442,080	87,542,422	3,459,034		263,820	15,146,500				
0	208,124,600	205,661,000	2,463,600	46,207,142	47,412,624	28,751,931	20,192,367	(G) 2,676,494	3,710,900	270,520				
600	143,522,953	132,078,250	11,444,703	13,163,711	21,817,421	76,372,654	3,684,442	0	7,257,604	208,140				
0	136,633,985	0	136,633,985	16,061,151	14,679,078	73,035,238	1,956,716		13,725,165	6,606,126				
(C) 16,275	130,897,921	114,762,550	16,135,371	9,137,178	11,422,681	54,984,792	2,108,585		2,034,049	31,531,881	(N)			
13,800	109,489,363	107,484,163	2,005,200	10,496,553	10,609,846	15,782,145	2,191,945	574,293		43,821,078				
0	100,652,334	0	100,652,334	13,848,561	24,797,656	41,187,356	1,153,036	215,708	2,821,628					
1,367,414	8,509,782,857	6,773,729,970	1,736,052,887											
(C) 398,300	1,860,805,943	1,421,009,577	439,796,366	62,243,551	66,739,414	669,736,166	6,822,129		8,438,579	796,621,843	(N)			
(L) 133,243	762,528,751	553,931,181	208,597,570	52,831,002	58,815,541	309.274,010	6,422,952		34,578,577	155,052,833				
80,320	450,407,520	420,086,580	30,320,940	41,931,335	44,579,954	103,411,086	22,262,879		43,317,870	151,683,710				
184,000	345,603,400	345,603,400	0	0	0	0	0	0	0	338,867,000				
0	252,222,842	0	252,222,842	26,095,742	23,614,227	133,375,842	2,954,522	(G) 195,350	37,803,889					
24,540	249,540,548	208,038,390	41,502,158	16,904,331	29,408,584	79,589,932	6,364,791	(A) 1,671,806	381,829	75,691,465				
0	189,341,440	187,566,400	1,775,040	22,585,254	47,419,691	42,280,889	8,708,119	216,232	28,338,813	15,710,680				
0	146,433,090	5,135,431	141,297,659	16,276,059	19,922,254	55,758,945	13,578,598	1,626,953	2,010,143	222,983				
0	118,526,461	19,990,426	98,536,035	16,992,779	26,342,589	45,372,420	3,296,640		1,104,744	2,383,063				
150	112,918,808	374,000	112,544,808	12,271,334	15,343,092	60,971,960	2,911,455	0	8,073,444	957,877				
820,553	4,488,328,803	3,161,735,385	1,326,593,418											
0	612,119,000	537,880,000	74,239,000	8,572,167	7,618,878	171,746,880	3,552,532	1,143,905		388,300,539				
0	524,913,000	501,423,000	23,490,000	40,760,000	84,338,000	258,384,000	30,550,000	4,654,000	28,291,000	25,933,000				
0	521,669,355	509,195,355	12,474,000	32,481,617	53,668,662	202,298,721	23,322,334	657,285	17,832,819	118,964,920				
0	489,174,640	464,045,390	25,129,250	47,729,520	56,517,072	241,938,311	27,990,550	1,083,749	18,841,528	18,051,826				
885	445,325,000	317,060,000	128,265,000	40,204,655	47,389,569	191,122,410	25,745,483	(G) 2,180,566	19,739,670	34,200,799				
0	341,034,400	341,034,400	0	32,211,075	39,173,532	99,577,896	18,441,506		41,476,120	70,558,728				
(L,S) 37,666	304,690,000	49,454,000	255,236,000	21,156,094	28,379,013	135,991,734	7,651,141	(G) 938,552	9,468,421	30,061,772				
0	266,182,789	132,076,485	134,106,304	17,894,062	23,352,162	129,783,374	6,182,992	(G) 12,933,664	2,634,533	20,628,874				
5,400	249,425,222	223,747,139	25,678,083	20,846,770	30,695,515	86,194,340	2,827,336	15,661,371	690,337	7,329,817				
0	220,291,750	217,805,500	2,486,250	32,325,851	76,054,002	32,990,267	24,519,361	188,494	29,072,350	2,396,198				
0	203,968,162	199,233,218	4,734,944	18,435,116	20,651,018	60,784,791	5,701,427	(A) 1,186,371	157,403	48,319,708				
0	200,698,570	168,467,323	32,231,247	26,472,694	20,687,294	96,606,112	4,177,813	(A) 412,542	4,335,149	12,934,444				
1,590	199,783,901	155,656,570	44,127,331	23,460,130	62,645,852	40,046,060	3,259,610	844,835	9,203,268	22,221,798				
0	196,644,219	153,086,164	43,558,055	19,743,396	23,589,297	89,546,624	7,852,979		6,637,298	14,511,694				
0	110,485,989	110,485,989	0	9,594,719	24,662,897	49,560,052	2,022,063	(G) 1,271,962	6,185,040	0				
45,541	4,886,405,997	4,080,650,533	805,755,464											
293,400	937,014,000	933,669,000	3,345,000	37,087,591	40,657,528	624,465,036	7,583,937	(G) 2,892,782	80,766,813	6,115,375				
(L) 182,472	650,549,000	431,559,000	218,990,000	63,009,578	(z)	(z) 413,070,820	17,300,460	130,329	41,872,309	8,100,995				
71,500	450,864,575	426,172,842	24,691,733	31,872,533	30,144,039	51,944,115	10,223,853	(G) 21,682,004		(W)238,968,106				
(L) 33,900	318,427,572	315,270,408	3,157,164	46,670,888	49,607,684	125,160,972	9,255,504		303,631	24,975,946				
70,050	292,324,270	231,056,685	61,267,585	(A) 5,766,679	0	0	5,744,504	(Y)137,401,348	0	58,833,097				
651,322	2,649,179,417	2,337,727,935	311,451,482											
(L) 879,144	4,558,552,038	3,997,825,977	560,726,061	445,949,765	276,840,032	1,379,491,710	60,956,110	678,667,513	299,537,253	216,223,552				
(L) 490,140	3,061,836,977	3,044,636,122	17,200,855	260,392,933	185,436,684	743,090,811	46,652.316	471,388,765	262,199,972	578,645,513				
150,735	911,955,295	819,618,077	92,337,218	123,789,030	178,434,235	244,471,500	24,095,536	(G) 39,339,141	61,359,318	25,252,600				
206,234	784,134,417	772,523,090	11,611,327	86,073,307	60,044,054	241,540,541	21,777,848	(G) 36,077,501	52,111,319	(Z) 151,642,157				
96,605	759,028,656	277,123,000	481,905,656											
107,480	603,182,100	594,132,200	9,049,900	89,788,685	36,819,652	225,135,759	26,162,124		61,973,452	56,421,681				
92,880	465,156,805	380,796,014	84,360,791	36,294,164	14,658,017	53,623,328	2,070,670	0	0	274,982,507				
0	429,006,384	428,994,952	11,432	(i) 183,652,897	(i)	(aa) 96,810,703	4,716,481		0	83,452,600				
97,500	353,764,500	350,457,900	3,306,600	90,619,627	63,850,166	57,264,391	27,396,044	237,034	36,856,330	0				
83,600	309,450,010	309,449,010	1,000	0	0	0	0	0	0	255,640,000				
9,600	287,290,707	188,273,471	99,017,236	38,655,456	44,500,804	147,090,940	4,782,898			8,284,631				
58,575	(b) 275,500,157	(b) 164,460,987	111,039,170	(ee) 7,887,728	(ff) 14,708,510	133,139,262	5,733,749	(gg) 9,345,649	0	24,110,201				
139,000	253,913,000	252,284,000	1,629,000	42,548,687	146,354,627		9,581,207		1,124,250	7,077,556				
(L) 22,642	230,487,553	134,196,449	96,291,104	(k) 64,190,223	77,688,621		3,273,769		2,107,780	35,323,530				
0	198,800,090	195,898,100	2,901,990	34,245,026	31,127,879	67,238,884	6,568,146		14,640,300	8,830,119				
6,110	127,099,816	32,113,720	94,986,096	32,076,004	13,553,147	45,485,013	3,156,170			1,468,690				
2,440,245	13,609,158,505	11,942,783,069	1,666,375,436											
943,150	4,387,316,157	3,223,006,488	1,164,309,669											
(hh) 604,800	(hh)3,436,436,460	(hh)2,864,915,469	571,520,991	13,096,349	83,808,266	2,496,348,588	7,697,803			589,396,776				
506,014	2,414,375,792	2,412,322,542	2,053,250	(m) 28,858,232	(m)	2,368,924,860	1,250,000	0	4,100,000	242,700				
215,410	1,557,929,949	763,929,381	794,000,568	120,782,729	159,697,826	964,856,539	17,473,000		124,463,819	35,206,420				
363,000	1,518,632,376	1,518,632,376	0			1,001,577,575				517,054,801				
235,375	614,665,600	614,665,600	0	71,807,778	17,870,339	277,326,511	69,642,355	36,662,987	40,510,648	25,649,422				
123,000	591,772,849	591,772,849	0	5,573,702	1,387,512	521,828,425				4,880,517				
75,000	490,148,000	490,148,000												
(kk) 167,335	(jj)425,510,139	425,510,139	0	69,530,503	55,885,268	155,690,469	12,516,567		82,308,751	6,545,272				
94,375	418,226,810	418,226,810	0	8,507,857	4,445,300	354,469,169	718,854		864,000					
(L) 96,234	412,080,147	346,100,772	65,979,375	166,820,047	72,798,990	48,535,562	13,956,720	(mm)40,287,700		11,096,882				
(L) 52,100	188,668,281	184,817,474	3,850,807	2,714,597	5,118,058	157,783,825	1,081,636	1,246,991						
(oo) 62,630	173,924,966	173,924,966	0	173,293	175,370	122,992,430	24,000			43,401,139				
43,875	159,873,880	142,910,400	16,963,480	11,527,500	21,287,224	44,668,916	2,642,940	(G) 654,000	1,492,800	70,397,282				
45,000	146,048,890	146,048,890	0	0	0	0	0	0	0	146,048,890				
3,572,955	16,935,610,296	14,316,932,156	2,618,678,140											
179,498	691,150,190	691,150,190	0	20,516,633	47,182,486	255,082,001	46,227,524	20,334,736	78,512,818					
	South Atlantic States													
82	Duke Power Company	8	(L) 306,650	40	(L) 597,205	1,768,184,411	1,461,676,952	306,507,459	(K)					

0	0	0	0	0	0	146,048,890	0	0	0	0	0
	6,653,613	0	0	0	0	0	0	3	59	
1,713,804	28,335,805	83,216	9,879	848	185		1	5	60	
	13,045,532	0	13	5		0		0	61	
1,736,687	26,817,359	35,822	7,068	1,699	66		(E)	9	62	
15,288,860	21,347,421	37,949	6,874	1	143				63	
23,232,583	11,175,706	17,564	3,174	1,271	39	3,682	2	7	64	
176,767	13,226,459	34,965	7,164	160	25		1	4	65	
1,287,507	19,332,560	30,829	4,823	98	19			4	66	
7,776	2,428,000	0	0	0	0	1	3	2	67	
720,089	13,104,788	21,284	4,092	1,057	96		(E)	8	68	
7,840,997	197,091,225	276,100	41,624	333	39		3	21	69	
10,733,881	175,356,478	292,400	50,506	21,154	720		2	77	70	
302,787	64,124,626	106,764	26,177	140	386		2	9	71	
1,609,640	65,193,528	(k) 36,394	6,740	387	67		1	22	72	
	28,234,914	56,783	8,259	216	39	(G) 1,095	1	2	73	
778,959	36,724,914	(k) 51,267	8,234	642	44		7	19	74	
954,693	25,356,036	44,671	5,735	2,161	216	(A) 1,396		4	75	
861,179	36,875,688	19,227	5,025	1,406	52		2	9	76	
4,655,443	27,650,982	59,675	11,672	3,734	167	(J) 4,835	1	34	77	
1,223,764	18,317,566	26,770	5,324	838	152	(A) 795		15	78	
313,321	28,774,327	61,001	14,499	4,088	488		2	49	79	
1,799,038	17,270,329	38,900	7,626	2	87	(A) 2,441	3	17	80	
3,247,330	24,094,039	28,402	6,869	2,037	100	(A) 902		23	81	
78,857,579	274,839,628	(K)	(K)	604	(K)	(K)	(K)		82	
(N) 8,940,640	256,611,666	115,997	35,006	423	473		1	47	83	
5,712,259	134,656,573	106,217	24,657	669	141	305	8	30	84	
11,593,486	89,021,167	197,721	25,143	333	20		1		85	
1,292,703	135,733,093	50,096	13,702	903	(P) 946	0		(P) 9	86	
(n)	(n) 110,391,163	94,518	19,030	913	476	(G) 1,949	6	11	87	
4,376,160	89,928,256	131,951	17,656	251	37		4	1	88	
(N) 4,058,195	30,397,458	11,445	3,200	478	87		1	7	89	
12,674,665	37,813,472	(R) 51,704	9,392	2,071	78		2	4	90	
12,087,179	46,815,443	61,012	15,664	904	1,118	(G) 1,129	1	1	91	
2,020,762	18,998,219	28,760	5,677	279	(g) 22	0		(g)	92	
552,286	10,018,225	28,843	5,652	181	53		2	3	93	
(N) 513,264	19,165,491	15,245	5,585	85	56		(E)	2	94	
2,445,291	23,568,212	20,647	5,767	214	126	646		14	95	
866,058	15,762,331	24,275	4,949	54	25	55	3		96	
(N) 4,052,052	246,152,209	79,411	24,462	632	170		(E)	51	97	
5,885,623	139,668,213	91,732	23,064	1,032	96		2	6	98	
2,863,730	40,356,956	74,707	11,118	3,609	356		1	4	99	
6,736,400	0	0	0	0	0	0	0	1	100	
1,116,230	27,067,040	49,096	8,090	303	6	(G) 40			101	
5,220,394	34,307,416	42,419	13,629	148	179	(A) 3,738	1	27	102	
1,275,035	22,806,727	38,210	9,344	194	150	344	1	4	103	
2,392,869	34,644,286	25,681	8,876	834	757	1,026		2	104	
736,238	22,297,988	28,713	10,901	145			1	2	105	
1,666,997	10,722,649	21,855	3,473	253	180	0		1	106	
871,160	30,312,939	18,057	5,169	363	234	1,247		6	107	
1,953,000	50,050,000	81,743	13,393	909	473	328	2	6	108	
	72,442,997	59,846	11,522	1,196	516	413	3		109	
4,447,261	72,574,823	96,565	23,721	8,984	797	860	4	26	110	
(n)	(n) 84,741,848	80,739	22,522	1,389	941	(G) 1,355	4	15	111	
659,559	38,935,984	73,768	12,796	331	427			6	112	
7,365,352	63,677,921	43,822	13,008	814	777	(G) 919	3	8	113	
(n)	(n,T)52,773,128	31,107	8,773	391	35	(G) 374	2	13	114	
30,467,750	54,711,986	34,925	16,270	775	89	2,101	(E)	10	115	
1,558,625	21,186,602	58,080	8,711	558	268	48	1	1	116	
9,784,443	38,947,885	30,668	11,158	480	183	(A) 1,026	1	3	117	
6,533,037	28,539,485	49,738	10,278	2,895	80	(A) 804	3	4	118	
821,392	37,280,956	51,478	10,522	244	11	1		4	119	
6,914,284	27,848,647	41,286	10,880	2,437	116		2	6	120	
(n)	(n) 17,189,256	18,520	4,587	255	59	(G) 742	(E)	0	121	
(n)	(n) 137,444,938	51,377	10,947	227	91	(G) 1,788	5	11	122	
2,940,091	104,124,418	81,585	(z)	(z) 10,312	888		6	15	123	
2,954,176	63,075,749	24,806	5,198	472	553	(G) 8,721		(W) 10	124	
3,961,845	58,491,102	101,452	16,414	6,601	78		1	9	125	
45,624,656	38,953,986	(A) 3,830	0	0	7	(Y) 352	0	2	126	
91,030,401	1,109,855,702	580,012	36,595	85,130	618	38,067	17	30	127	
5,511,453	508,518,530	391,344	50,366	19,670	312	15,729	3	11	128	
(n)	(n) 215,213,935	117,419	22,159	939	463	(G) 24,061	9	14	129	
2,058,347	132,809,343	48,372	8,428	313	681	(G) 4,858	3	(Z) 11	130	
									131	
2,154,800	104,725,947	94,074	11,937	382	250		6	8	132	
3,532,603	79,995,516	19,263	4,349	1,190	84	0	0	6	133	
5,321,182	55,052,521	(h, i) 158,273	(i)	(h,aa) 10,362	(h) 254		0	(h) 1	134	
3,752,449	73,788,459	82,259	(bb) 9,343	(cc) 3,036	1	12	1	1	135	
34,020,560	19,789,450	0	0	0	0	0	0	2	136	
880,585	43,095,393	33,638	5,409	43	153			3	137	
2,770,941	77,804,117	(ee) 18,055	(ff) 5,953	3,038	125	(gg) 3,310	0	14	138	
9,536,342	37,690,331	27,456	5,222		2		1	15	139	
3,520,136	44,383,494	(k) 41,381	7,889		120		2	5	140	
9,408,405	26,741,331	57,400	11,397	4,833	23		1	4	141	
2,259,038	29,101,754	38,751	9,040	2,835	77			6	142	
									143	
15,196,760	230,891,918	41,442	8,532	35	228			3	144	
	11,000,000	(m) 20,132	(m)	23	85	0	1	3	145	
	135,449,616	205,029	48,288	420	20		1	14	146	
				4				3	147	
	75,195,560								148	
6,186,399	51,916,294	2,867	425	6				7	149	
									150	
6,907,444	36,125,865	79,487	12,756	2,728	16			2	151	
	49,221,630	9,126	2,232	46	13		1		152	
	58,584,246	40,317	6,070	(nn)	7			2	153	
	20,723,174	7,179	4,602	12	95	22			154	
726,548	6,432,186	614	2	3	1			11	155	
	7,203,218	20,478	4,879	68	114	(G) 1,300	1	5	156	
0	0	0	0	0	0	0	0	2	157	
10,843,620	212,450,372	115,323	41,217	357	1,250	20,198	1		158	

(z) Retail combined with wholesale.

(A) Rural service.

(B) Includes 35,853 hall light customers.

(C) Additional capacity is available by contract, or by lease and contract, as follows:

Co. No.	Kw.
46	19,560
48	20,000
83	26,278
94	2,000
97	230,700
105	3,673

(D) Includes company's share of jointly owned plant (Windsor).

(E) Company-owned.

(F) Includes one plant, 186 kw., internal combustion.

(G) Farm service.

(H) Includes one plant, 1,100 kw., internal combustion.

(I) Of this the output of the interconnected part of the system is 118,504,179 kw.-hr.

(J) Fuel consumers and rural service.

(K) Company sells at wholesale only. No segregated classification.

(L) Leased plants.
The reported number and rating includes plants (not in general segregated as to kind of power) operated under contract or lease as follows:

Co. No.	No. of Plants	Kw.	
2	1	50	(Hydro)
15	5	49,500	
16	1	28,000	(Fuel)
17	1	40,800	
39	2	.....	(Hydro)
41	1	16,000	(Fuel)*
54	2	12,500	
57	2	20,500	
82	5	119,400	
90	1	7,500	
98	1	3,000	
109	1	9,200	(Fuel)
111	1	2,000	(Fuel)
113	2	390	
123	5	28,300	
125	1	600	
127	6	107,200	
128	1	1,800	
133	1	15,000	(Fuel)
140	1	1,100	
153*	2	96,234	(Hydro)*
154	1	12,975	
169	2	16,000	(Hydro)

*River rights leased but plants owned by city.

(M) Net from interchange.

(N) Includes energy used in gas, water, bus or ice departments, or in combinations of such departments.

(O) Includes Kentucky & West Virginia Power Co. and Kingsport Utilities, Inc.

(P) Sales to municipal systems included under municipal service.

(Q) Includes Broad River Power Co. and Lexington Water Power Co.

(R) Includes rural service.

(S) Includes Carpenter development — first 28,000 kw. placed in service December, 1931.

(T) Includes 11,366 kw.-hr. free service.

(U) Operating.

(V) Of these thirteen are standby plants.

(W) Includes 226,251,694 kw.-hr., four customers, interchange.

(X) Includes, three plants, 2,100 kw. internal combustion.

(Y) Irrigation power.

(Z) Includes 106,000 kw.-hr., one customer, interchange.

(aa) Reported as commercial power (retail).

(bb) Commercial lighting.

(cc) Commercial power.

(dd) Includes Nevada-California Power Co., Southern Sierras Power Co. and Yuma Utilities Co.

(ee) Includes heat: residential, 1,804,310 kw.-hr., 1,270 customers.

(ff) Includes heat: commercial, 5,961,969 kw.-hr., 1,101 customers (the customers of notes *ee* and *ff* have been added to the totals, but presumably duplicate lighting customers. —Editor)

(gg) Combination light and heat.

(hh) Includes 25,150 kw., 189,038,749 kw.-hr. sold as hydraulic power.

(ii) Includes Manitoba Power Co., Ltd., and Northwestern Power Co., Ltd.

(jj) Lower mainland system only.

(kk) Kva.

(ll) Standby.

(mm) Off-peak, central heating.

(nn) 1,378 customers included in other groups.

(K)	1,414,430,124	(K)	(K)	(K)	(M) 57,080	78,857,579	274,839,628	(K)	(K)	604

179,498	691,150,190	691,150,190	0	20,516,633	47,182,486	255,082,001	46,227,524	20,334,736	78,512,818			

	South Atlantic States											
82	Duke Power Company	8	(L)	306,650	40	(L)	597,205	1,768,184,411	1,461,676,952	306,507,459	(K)	
83	Georgia Power Company	18	(C)	90,531	27	(C)	290,443	1,319,011,309	872,961,970	446,049,339	88,180,205	
84	Appalachian Electric Power Company (O)	10		340,440	5		44,900	1,276,642,108	1,197,363,345	79,278,763	57,621,823	
85	Consolidated Gas, Elec. Lt. & Pwr. Co. of Baltimore	3		257,000	1		600	884,250,577	610,681,264	273,569,313	136,921,757	
86	Carolina Power & Light Company	4		46,750	12		206,300	731,648,290	521,459,820	210,188,470	32,529,628	
87	Virginia Electric & Power Company	10		132,710	9		28,050	534,628,983	407,405,365	127,223,618	55,323,060	
88	The North American Co. Sys. (Dist. of Columbia Group)	1		208,000	0		0	519,295,192	519,295,192	0	91,974,333	
89	Assoc. Gas & Elec. System (South Carolina Group) (Q)	2		78,000	4		154,705	425,907,556	415,962,105	9,945,451	6,169,641	
90	Virginia Public Service Company	4	(L)	66,950	12	(L)	14,536	220,893,275	206,937,994	13,955,281	(R) 42,551,282	
91	Florida Power & Light Company	40		139,840	0		0	208,124,600	205,661,000	2,463,600	46,207,142	
92	Tampa Electric Company	3		36,625	1		600	143,522,953	132,078,250	11,444,703	13,163,711	
93	Delaware Power & Light Company	0		0	0		0	136,633,985	0	136,633,985	16,061,151	
94	South Carolina Power Company	6	(C)	20,032	2	(C)	16,275	130,897,921	114,762,550	16,135,371	9,137,178	
95	Florida Power Corporation and Subsidiaries	10		45,224	2		13,800	109,489,363	107,484,163	2,005,200	10,496,553	
96	Wheeling Electric Company	2		9,360	0		0	100,652,334	0	100,652,334	13,848,561	
	Totals for Section	121		1,778,112	115		1,367,414	8,509,782,857	6,773,729,970	1,736,052,887		
	East South Central States											
97	Alabama Power Company	14	(C)	156,603	6	(C)	398,300	1,860,805,943	1,421,009,577	439,796,366	62,243,551	
98	The Tennessee Electric Power Company	16	(L)	109,370	15	(L)	133,243	762,528,751	553,931,181	208,597,570	52,831,002	
99	Louisville Gas & Electric Company (Del.) Subsidiaries	3		112,020	1		80,320	450,407,520	420,086,580	30,320,940	41,931,335	
100	U. S. Government (Muscle Shoals)	0		0	1		184,000	345,603,400	345,603,400	0	0	
101	Birmingham Electric Company	1		11,700	0		0	252,222,842	0	252,222,842	26,095,742	
102	Kentucky Utilities Company	(V) 17		54,372	2		24,540	249,540,548	208,038,390	41,502,158	16,904,331	
103	Memphis Power & Light Company	1		54,000	0		0	189,341,440	187,566,400	1,775,040	22,585,254	
104	Mississippi Power & Light Company	47		20,488	0		0	146,433,090	5,135,431	141,297,659	16,276,059	
105	Mississippi Power Company	26	(C)	25,572	0		0	118,526,461	19,990,426	98,536,035	16,992,779	
106	Tennessee Public Service Company	3		6,405	1		150	112,918,808	374,000	112,544,808	12,271,334	
	Totals for section	128		550,530	26		820,553	4,488,328,803	3,161,735,385	1,326,593,418		
	West South Central States											
107	Louisiana Power & Light Company	15		90,122	0		0	612,119,000	537,880,000	74,239,000	8,572,167	
108	Houston Lighting & Power Company	7		175,681	0		0	524,913,000	501,423,000	23,490,000	40,760,000	
109	Texas Electric Service Company	12	(L)	101,766	0		0	521,669,355	509,195,355	12,474,000	32,481,617	
110	Oklahoma Gas & Electric Company	17		188,112	0		0	489,174,640	464,045,390	25,129,250	47,729,520	
111	Texas Power & Light Company	15	(L)	99,254	4		885	445,325,000	317,060,000	128,265,000	40,204,655	
112	New Orleans Public Service Inc.	1		108,000	0		0	341,034,400	341,034,400	0	32,211,075	
113	Arkansas Power & Light Company	44	(L)	41,506	3	(L,S)	37,666	304,690,000	49,454,000	255,236,000	21,156,094	
114	Gulf States Utilities Company	15		80,008	0		0	266,182,789	132,076,485	134,106,304	17,894,062	
115	Central Power & Light Company	(U) 11	(U)	53,666	4		5,400	249,425,222	223,747,139	25,678,083	20,846,770	
116	Dallas Power & Light Company	1		82,500	0		0	220,291,750	217,805,500	2,486,250	32,325,851	
117	West Texas Utilities Company	22		53,990	0		0	203,968,162	199,233,218	4,734,944	18,435,116	
118	Public Service Company of Oklahoma	14		79,320	0		0	200,698,570	168,467,323	32,231,247	26,472,694	
119	San Antonio Public Service Company	4		98,250	3		1,590	199,783,901	155,656,570	44,127,331	23,460,130	
120	Southwestern Gas & Electric Company	15		45,850	0		0	196,644,219	153,086,164	43,558,055	19,743,396	
121	El Paso Electric Company (and Affiliates)	5		60,308	0		0	110,485,989	110,485,989	0	9,594,719	
	Totals for section	198		1,358,333	14		45,541	4,886,405,997	4,080,650,533	805,755,464		
	Mountain States											
122	The Montana Power Company	2		900	11		293,400	937,014,000	933,669,000	3,345,000	37,087,591	
123	Utah Power & Light Company	5	(L)	42,740	37	(L)	182,472	650,549,000	431,559,000	218,990,000	63,009,578	
124	Idaho Power Company	0		0	8		71,500	450,864,575	426,172,842	24,691,733	31,872,533	
125	Public Service Company of Colorado	(X) 14	(L,X)	89,200	10	(L)	33,900	318,427,572	315,270,408	3,157,164	46,670,888	
126	Salt River Valley Water Users' Association	0		0	8		70,050	292,324,270	231,056,685	61,267,585	(A) 5,766,679	
	Totals for section	21		132,840	74		651,322	2,649,179,417	2,337,727,935	311,451,482		
	Pacific States											
127	Pacific Gas & Electric Company and all Subsidiaries	15	(L)	380,600	50	(L)	879,144	4,558,552,038	3,997,825,977	560,726,061	445,949,765	
128	Southern California Edison Company, Ltd.	5	(L)	461,600	24	(L)	490,140	3,061,836,977	3,044,636,122	17,200,855	260,392,933	
129	Puget Sound Power & Light Company	7		112,000	14		150,735	911,955,295	819,618,077	92,337,218	123,789,030	
130	The Washington Water Power Company	1		150	12		206,234	784,134,417	772,523,090	11,611,327	86,073,307	
131	City of Los Angeles, Dept. of Water and Power	0		0	5		96,605	759,028,656	277,123,000	481,905,656		
132	Portland General Electric Company	3		88,000	6		107,480	603,182,100	594,132,200	9,049,900	89,788,685	
133	The California Oregon Power Company	3	(L)	15,410	11		92,880	465,156,805	380,796,014	84,360,791	36,294,164	
134	Los Angeles Gas & Electric Corporation	2		148,700	0		0	429,006,384	428,994,952	11,432	(i) 183,652,897	
135	City of Seattle, Dept. of Lighting	1		30,000	4		97,500	353,764,500	350,457,900	3,306,600	90,619,627	
136	Hetch Hetchy Water Supply, City & County of San Francisco	0		0	2		83,600	309,450,010	309,449,010	1,000	0	
137	Northwestern Electric Company	2		42,500	1		9,600	287,290,707	188,273,471	99,017,236	38,655,456	
138	The Nevada-California Electric Corporation System (dd)	3		8,257	11		58,575	(b) 275,500,157	(b) 164,460,987	111,039,170	(ee) 7,887,728	
139	City of Tacoma, Dept. Public Utilities, Light Division	1		9,000	3		139,000	253,913,000	252,284,000	1,629,000	42,548,687	
140	Pacific Power & Light Company	4	(L)	11,150	10	(L)	22,642	230,487,553	134,196,449	96,291,104	(k) 64,190,223	
141	San Diego Consolidated Gas & Electric Company	2		74,000	0		0	198,800,090	195,898,100	2,901,990	34,245,026	
142	Mountain States Power Company	21		31,345	7		6,110	127,099,816	32,113,720	94,986,096	32,076,004	
	Totals for section	70		1,412,712	160		2,440,245	13,609,158,505	11,942,783,069	1,666,375,436		
	Canada											
143	Hydro-Electric Power Commission of Ontario	1		18,000	39		943,150	4,387,316,157	3,223,006,488	1,164,309,669		
144	The Shawinigan Water & Power Company	0		0	8	(hh)	604,800	(hh) 3,436,436,460	(hh) 2,864,915,469	571,520,991	13,096,349	
145	Canadian Hydro-Electric Corporation, Ltd. System	1		6,750	18		506,014	2,414,375,792	2,412,322,542	2,053,250	(m) 28,858,232	
146	Montreal Light, Heat & Power Consolidated	1		16,500	4		215,410	1,557,929,949	763,929,381	794,000,568	120,782,729	
147	Duke-Price Power Company, Ltd.	0		0	1		363,000	1,518,632,376	1,518,632,376	0		
148	Winnipeg Electric Company (ii)	1		12,000	3		235,375	614,665,600	614,665,600	0	71,807,778	
149	West Kootenay Power & Light Company, Ltd.	0		0	3		123,000	591,772,849	591,772,849	0	5,573,702	
150	Canadian Niagara Power Company, Ltd.	0		0	1		75,000	490,148,000	490,148,000			
151	British Columbia Electric Railway Company, Ltd. (jj)	1	(kk)	17,500	6	(kk)	167,335	(jj) 425,510,139	425,510,139	0	69,530,503	
152	Canada Northern Power Corporation, Ltd. System	0		0	9		94,375	418,226,810	418,226,810	0	8,507,857	
153	City of Winnipeg Hydro-Electric System	(ll) 1	(ll)	11,190	2	(L)	96,234	412,080,147	346,100,772	65,979,375	166,820,047	
154	Calgary Power Company, Ltd.	6	(L)	17,849	4	(L)	52,100	188,668,281	184,817,474	3,850,807	2,714,597	
155	The Nova Scotia Power Commission	0		0	12	(oo)	62,630	173,924,966	173,924,966	0	173,293	
156	Southern Canada Power Company, Ltd.	0		0	5		43,875	159,873,880	142,910,400	16,963,480	11,527,500	
157	Montreal Island Power Company	0		0	1		45,000	146,048,890	146,048,890	0	0	
	Totals for Canada	12		96,289	116		3,572,955	16,935,610,296	14,316,932,156	2,618,678,140		
	Mexico											
158	The Mexican Light & Power Company, Ltd. (Data on other large companies not available)	2		32,240	14		179,498	691,150,190	691,150,190	0	20,516,633	
	Electric Railways and Electrified Railroads											
159	Interborough Rapid Transit Company	2		390,000	0		0	1,198,884,267	1,198,822,920	61,347		
160	Williamsburg Power Plant Corporation (B.M.T.)	2		204,100	0		0	642,157,665	641,776,965	380,700		
161	Chicago Surface Lines	0		0	0		0	595,733,093	0	595,733,093		
162	Philadelphia Rapid Transit Company	0		0	0		0	333,822,958	0	333,822,958		
163	The Pennsylvania Railroad (L. I. City Gen. Sta.)	1		88,000	0		0	330,309,340	260,506,340	69,803,000		
164	Boston Elevated Railway	4		164,900	0		0	257,065,945	257,065,945	0		
165	The New York Central Railroad Company	2		110,000	0		0	250,573,893	193,196,893	57,377,000		
166	The New York, New Haven & Hartford RailroadCompany	1	(kk)	62,840	0		0	213,400,000	113,800,000	99,600,000		
167	St. Louis Public Service Company	2		21,600	0		0	159,433,615	14,006,405	145,427,210		
168	Pacific Electric Railway Company	0		0	0		0	157,888,334	0	157,888,334		
169	Twin City Rapid Transit Company	1		75,000	2	(L)	16,000	126,174,466	95,563,893	(pp) 30,610,573		
170	Norfolk & Western Railway Company	6		43,855	0		0	116,745,039	85,619,384	31,125,655		
171	Chicago, Milwaukee, St. Paul & Pacific Railroad Co. (qq)	0		0	0		0	91,042,859	0	91,042,859		
172	The Connecticut Company (rr)	1		22,500	0		0	89,641,092	36,534,900	53,106,192		
	Totals for Railways and Railroads	22		1,170,227	2		16,000	4,562,872,566	2,896,893,645	1,665,978,921		

597,205	1,768,184,411	1,461,676,952	306,507,459	(K)	(K)	1,414,430,124	(K)	(K)	(K)	(M) 57,080	78	
290,443	1,319,011,309	872,961,970	446,049,339	88,180,205	150,492,790	592,355,191	17,726,829		57,493,911	147,210,077	(N) 8	
44,900	1,276,642,108	1,197,363,345	79,278,763	57,621,823	88,257,881	940,965,863	6,123,883	2,706,494	24,818,607	15,778,725	5	

| | | |

) 597,205	1,768,184,411	1,461,676,952	306,507,459	(K)	(K)	1,414,430,124	(K)	(K)	(K)	(M) 57,080	7
) 290,443	1,319,011,309	872,961,970	446,049,339	88,180,205	150,492,790	592,355,191	17,726,829		57,493,911	147,210,077	(N)
44,900	1,276,642,108	1,197,363,345	79,278,763	57,621,823	88,257,881	940,965,863	6,123,883	2,706,494	24,818,607	15,778,725	
600	884,250,577	610,681,264	273,569,313	136,921,757	96,537,895	390,193,556	24,206,390		135,776,326		1
206,300	731,648,290	521,459,820	210,188,470	32,529,628	27,642,875	222,371,125	(P) 33,808,738	0	5,000,900	(P)273,269,228	
28,050	534,628,983	407,405,365	127,223,618	55,323,060	90,382,964	240,728,602	11,726,441	(G) 2,648,883	4,363,270	19,064,600	
0	519,295,192	519,295,192	0	91,974,333	122,650,718	115,683,080	21,073,322		73,056,303	553,020	
154,705	425,907,556	415,962,105	9,945,451	6,169,641	6,685,620	82,387,233	3,333,081		802,276	292,074,052	(N)
) 14,536	220,893,275	206,937,994	13,955,281	(R) 42,551,282	21,442,080	87,542,422	3,459,034		263,820	15,146,500	1
0	208,124,600	205,661,000	2,463,600	46,207,142	47,412,624	28,751,931	20,192,367	(G) 2,676,494	3,710,900	270,520	1
600	143,522,953	132,078,250	11,444,703	13,163,711	21,817,421	76,372,654	3,684,442	0	7,257,604	208,140	
0	136,633,985	0	136,633,985	16,061,151	14,679,078	73,035,238	1,956,716		13,725,165	6,606,126	
) 16,275	130,897,921	114,762,550	16,135,371	9,137,178	11,422,681	54,984,792	2,108,585		2,034,049	31,531,881	(N)
13,800	109,489,363	107,484,163	2,005,200	10,496,553	10,609,846	15,782,145	2,191,945	574,293		43,821,078	
0	100,652,334	0	100,652,334	13,848,561	24,797,656	41,187,356	1,153,036	215,708	2,821,628		
1,367,414	8,509,782,857	6,773,729,970	1,736,052,887								
) 398,300	1,860,805,943	1,421,009,577	439,796,366	62,243,551	66,739,414	669,736,166	6,822,129		8,438,579	796,621,843	(N)
) 133,243	762,528,751	553,931,181	208,597,570	52,831,002	58,815,541	309,274,010	6,422,952		34,578,577	155,052,833	
80,320	450,407,520	420,086,580	30,320,940	41,931,335	44,579,954	103,411,086	22,262,879		43,317,870	151,683,710	
184,000	345,603,400	345,603,400	0	0	0	0	0	0	0	338,867,000	
0	252,222,842	0	252,222,842	26,095,742	23,614,227	133,375,842	2,954,522	(G) 195,350	37,803,889		
24,540	249,540,548	208,038,390	41,502,158	16,904,331	29,408,584	79,589,932	6,364,791	(A) 1,671,806	381,829	75,691,465	
0	189,341,440	187,566,400	1,775,040	22,585,254	47,419,691	42,280,889	8,708,119	216,232	28,338,813	15,710,680	
0	146,433,090	5,135,431	141,297,659	16,276,059	19,922,254	55,758,945	13,578,598	1,626,953	2,010,143	222,983	
0	118,526,461	19,990,426	98,536,035	16,992,779	26,342,589	45,372,420	3,296,640		1,104,744	2,383,063	
150	112,918,808	374,000	112,544,808	12,271,334	15,343,092	60,971,960	2,911,455	0	8,073,444	957,877	
820,553	4,488,328,803	3,161,735,385	1,326,593,418								
0	612,119,000	537,880,000	74,239,000	8,572,167	7,618,878	171,746,880	3,552,532	1,143,905		388,300,539	
0	524,913,000	501,423,000	23,490,000	40,760,000	84,338,000	258,384,000	30,550,000	4,654,000	28,291,000	25,933,000	
0	521,669,355	509,195,355	12,474,000	32,481,617	53,668,662	202,298,721	23,322,334	657,285	17,832,819	118,964,920	
0	489,174,640	464,045,390	25,129,250	47,729,520	56,517,072	241,938,311	27,990,550	1,083,749	18,841,528	18,051,826	
885	445,325,000	317,060,000	128,265,000	40,204,655	47,389,569	191,122,410	25,745,483	(G) 2,180,566	19,739,670	34,200,799	
0	341,034,400	341,034,400	0	32,211,075	39,173,532	99,577,896	18,441,506		41,476,120	70,558,728	
L,S) 37,666	304,690,000	49,454,000	255,236,000	21,156,094	28,379,013	135,991,734	7,651,141	(G) 938,552	9,468,421	30,061,772	
0	266,182,789	132,076,485	134,106,304	17,894,062	23,352,162	129,783,374	6,182,992	(G) 12,933,664	2,634,533	20,628,874	
5,400	249,425,222	223,747,139	25,678,083	20,846,770	30,695,515	86,194,340	2,827,336	15,661,371	690,337	7,329,817	3
0	220,291,750	217,805,500	2,486,250	32,325,851	76,054,002	32,990,267	24,519,361	188,494	29,072,350	2,396,198	
0	203,968,162	199,233,218	4,734,944	18,435,116	20,651,018	60,784,791	5,701,427	(A) 1,186,371	157,403	48,319,708	
0	200,698,570	168,467,323	32,231,247	26,472,694	20,687,294	96,606,112	4,177,813	(A) 412,542	4,335,149	12,934,444	
1,590	199,783,901	155,656,570	44,127,331	23,460,130	62,645,852	40,046,060	3,259,610	844,835	9,203,268	22,221,798	
0	196,644,219	153,086,164	43,558,055	19,743,396	23,589,297	89,546,624	7,852,979		6,637,298	14,511,694	
0	110,485,989	110,485,989	0	9,594,719	24,662,897	49,560,052	2,022,063	(G) 1,271,962	6,185,040	0	
45,541	4,886,405,997	4,080,650,533	805,755,464								
293,400	937,014,000	933,669,000	3,345,000	37,087,591	40,657,528	624,465,036	7,583,937	(G) 2,892,782	80,766,813	6,115,375	
L) 182,472	650,549,000	431,559,000	218,990,000	63,009,578	(z)	(z) 413,070,820	17,300,460	130,329	41,872,309	8,100,995	
71,500	450,864,575	426,172,842	24,691,733	31,872,533	30,144,039	51,944,115	10,223,853	(G) 21,682,004		(W)238,968,106	
L) 33,900	318,427,572	315,270,408	3,157,164	46,670,888	49,607,684	125,160,972	9,255,504		303,631	24,975,946	
70,050	292,324,270	231,056,685	61,267,585	(A) 5,766,679	0	0	5,744,504	(Y)137,401,348	0	58,833,097	4
651,322	2,649,179,417	2,337,727,935	311,451,482								
L) 879,144	4,558,552,038	3,997,825,977	560,726,061	445,949,765	276,840,032	1,379,491,710	60,956,110	678,667,513	299,537,253	216,223,552	9
L) 490,140	3,061,836,977	3,044,636,122	17,200,855	260,392,933	185,436,684	743,090,811	46,652,316	471,388,765	262,199,972	578,645,513	
150,735	911,955,295	819,618,077	92,337,218	123,789,030	178,434,235	244,471,500	24,095,536	(G) 39,339,141	61,359,318	25,252,600	
206,234	784,134,417	772,523,090	11,611,327	86,073,307	60,044,054	241,540,541	21,777,848	(G) 36,077,501	52,111,319	(Z) 151,642,157	
96,605	759,028,656	277,123,000	481,905,656								
107,480	603,182,100	594,132,200	9,049,900	89,788,685	36,819,652	225,135,759	26,162,124		61,973,452	56,421,681	
92,880	465,156,805	380,796,014	84,360,791	36,294,164	14,658,017	53,623,328	2,070,670	0	0	274,982,507	
0	429,006,384	428,994,952	11,432	(i) 183,652,897	(i)	(aa) 96,810,703	4,716,481		0	83,452,600	
97,500	353,764,500	350,457,900	3,306,600	90,619,627	63,850,166	57,264,391	27,396,044	237,034	36,856,330	0	
83,600	309,450,010	309,449,010	1,000	0	0	0	0	0	0	255,640,000	3
9,600	287,290,707	188,273,471	99,017,236	38,655,456	44,500,804	147,090,940	4,782,898			8,284,631	
58,575	(b) 275,500,157	(b) 164,460,987	111,039,170	(ee) 7,887,728	(ff) 14,708,510	133,139,262	5,733,749	(gg) 9,345,649	0	24,110,201	
139,000	253,913,000	252,284,000	1,629,000	42,548,687	146,354,627		9,581,207		1,124,250	7,077,556	
L) 22,642	230,487,553	134,196,449	96,291,104	(k) 64,190,223	77,688,621		3,273,769		2,107,780	35,323,530	
0	198,800,090	195,898,100	2,901,990	34,245,026	31,127,879	67,238,884	6,568,146		14,640,300	8,830,119	
6,110	127,099,816	32,113,720	94,986,096	32,076,004	13,553,147	45,485,013	3,156,170			1,468,690	
2,440,245	13,609,158,505	11,942,783,069	1,666,375,436								
943,150	4,387,316,157	3,223,006,488	1,164,309,669								
hh) 604,800	(hh)3,436,436,460	(hh)2,864,915,469	571,520,991	13,096,349	83,808,266	2,496,348,588	7,697,803			589,396,776	1
506,014	2,414,375,792	2,412,322,542	2,053,250	(m) 28,858,232	(m)	2,368,924,860	1,250,000	0	4,100,000	242,700	
215,410	1,557,929,949	763,929,381	794,000,568	120,782,729	159,697,826	964,856,539	17,473,000		124,463,819	35,206,420	
363,000	1,518,632,376	1,518,632,376	0			1,001,577,575				517,054,801	
235,375	614,665,600	614,665,600	0	71,807,778	17,870,339	277,326,511	69,642,355	36,662,987	40,510,648	25,649,422	
123,000	591,772,849	591,772,849	0	5,573,702	1,387,512	521,828,425				4,880,517	
75,000	490,148,000	490,148,000									
kk) 167,335	(jj)425,510,139	425,510,139	0	69,530,503	55,885,268	155,690,469	12,516,567		82,308,751	6,545,272	
94,375	418,226,810	418,226,810	0	8,507,857	4,445,300	354,469,169	718,854		864,000		
L) 96,234	412,080,147	346,100,772	65,979,375	166,820,047	72,798,990	48,535,562	13,956,720	(mm)40,287,700		11,096,882	
L) 52,100	188,668,281	184,817,474	3,850,807	2,714,597	5,118,058	157,783,825	1,081,636	1,246,991			
oo) 62,630	173,924,966	173,924,966	0	173,293	175,370	122,992,430	24,000			43,401,139	
43,875	159,873,880	142,910,400	16,963,480	11,527,500	21,287,224	44,668,916	2,642,940	(G) 654,000	1,492,800	70,397,282	
45,000	146,048,890	146,048,890	0	0	0	0	0	0	0	146,048,890	
3,572,955	16,935,610,296	14,316,932,156	2,618,678,140								
179,498	691,150,190	691,150,190	0	20,516,633	47,182,486	255,082,001	46,227,524	20,334,736	78,512,818		
0	1,198,884,267	1,198,822,920	61,347								
0	642,157,665	641,776,965	380,700								
0	595,733,093	0	595,733,093								
0	333,822,958	0	333,822,958								
0	330,309,340	260,506,340	69,803,000								
0	257,065,945	257,065,945	0								
0	250,573,893	193,196,893	57,377,000								
0	213,400,000	113,800,000	99,600,000								
0	159,433,615	14,006,405	145,427,210								
0	157,888,334	0	157,888,334								
L) 16,000	126,174,466	95,563,893	(pp) 30,610,573								
0	116,745,039	85,619,384	31,125,655								
0	91,042,859	0	91,042,859								
0	89,641,092	36,534,900	53,106,192								
16,000	4,562,872,566	2,896,893,645	1,665,978,921								

Summary of Generato

Section	Number of Companies or Systems	Number of Generating Plant — All Plants — No.	Rating, Kw.	— Fuel P — No.	
United States	**142**	**1,919**	**29,912,275**	**1,008**	**21**
New England	14	169	2,237,108	47	
Middle Atlantic (j)	23	346	8,091,602	147	
East North Central	31	298	6,825,358	164	
West North Central	13	179	2,200,605	112	
South Atlantic	15	236	3,145,526	121	
East South Central	10	154	1,371,083	128	
West South Central	15	212	1,403,874	198	
Mountain	5	95	784,162	21	
Pacific	16	230	3,852,957	70	
Canada	**15**	**128**	**3,669,244**	**12**	
Mexico	**1**	**16**	**211,738**	**2**	
Railways and Railroads	**14**	**24**	**1,186,227**	**22**	

78,857,579	274,839,628	(K)	(K)	604	(K)	(K)	(K)	.....	82
(N) 8,940,640	256,611,666	115,997	35,006	423	473	.....	1	47	83
5,712,259	134,656,573	106,217	24,657	669	141	305	8	30	84
11,593,486	89,021,167	197,721	25,143	333	20	.....	1	.....	85
1,292,703	135,733,093	50,096	13,702	903	(P) 946	0	.....	(P) 9	86
(n)	(n) 110,391,163	94,518	19,030	913	476	(G) 1,949	6	11	87
4,376,160	89,928,256	131,951	17,656	251	37	.....	4	1	88
(N) 4,058,195	30,397,458	11,445	3,200	478	87	.....	1	7	89
12,674,665	37,813,472	(R) 51,704	9,392	2,071	78	.....	2	4	90
12,087,179	46,815,443	61,012	15,664	904	1,118	(G) 1,129	1	1	91
2,020,762	18,998,219	28,760	5,677	279	(g) 22	0	.....	(g)	92
552,286	10,018,225	28,843	5,652	181	53	.....	2	3	93
(N) 513,264	19,165,491	15,245	5,585	85	56	.....	(E)	2	94
2,445,291	23,568,212	20,647	5,767	214	126	646	.....	14	95
866,058	15,762,331	24,275	4,949	54	25	55	3	.....	96
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(N) 4,052,052	246,152,209	79,411	24,462	632	170	.....	(E)	51	97
5,885,623	139,668,213	91,732	23,064	1,032	96	.....	2	6	98
2,863,730	40,356,956	74,707	11,118	3,609	356	.....	1	4	99
6,736,400	0	0	0	0	0	0	0	1	100
1,116,230	27,067,040	49,096	8,090	303	6	(G) 40	.....	.....	101
5,220,394	34,307,416	42,419	13,629	148	179	(A) 3,738	1	27	102
1,275,035	22,806,727	38,210	9,344	194	150	344	1	4	103
2,392,869	34,644,286	25,681	8,876	834	757	1,026	.....	2	104
736,238	22,297,988	28,713	10,901	145	.....	.....	1	2	105
1,666,997	10,722,649	21,855	3,473	253	180	0	.....	1	106
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
871,160	30,312,939	18,057	5,169	363	234	1,247	.....	6	107
1,953,000	50,050,000	81,743	13,393	909	473	328	2	6	108
.....	72,442,997	59,846	11,522	1,196	516	413	3	.....	109
4,447,261	72,574,823	96,565	23,721	8,984	797	860	4	26	110
(n)	(n) 84,741,848	80,739	22,522	1,389	941	(G) 1,355	4	15	111
659,559	38,935,984	73,768	12,796	331	427	.....	.....	6	112
7,365,352	63,677,921	43,822	13,008	814	777	(G) 919	3	8	113
(n)	(n,T)52,773,128	31,107	8,773	391	35	(G) 374	2	13	114
30,467,750	54,711,986	34,925	16,270	775	89	2,101	(E)	10	115
1,558,625	21,186,602	58,080	8,711	558	268	48	1	1	116
9,784,443	38,947,885	30,668	11,158	480	183	(A) 1,026	1	3	117
6,533,037	28,539,485	49,738	10,278	2,895	80	(A) 804	3	4	118
821,392	37,280,956	51,478	10,522	244	11	1	.....	4	119
6,914,284	27,848,647	41,286	10,880	2,437	116	.....	2	6	120
(n)	(n) 17,189,256	18,520	4,587	255	59	(G) 742	(E)	0	121
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(n)	(n) 137,444,938	51,377	10,947	227	91	(G) 1,788	5	11	122
2,940,091	104,124,418	81,585	(z)	(z) 10,312	888	.....	6	15	123
2,954,176	63,075,749	24,806	5,198	472	553	(G) 8,721	.....	(W) 10	124
3,961,845	58,491,102	101,452	16,414	6,601	78	.....	1	9	125
45,624,656	38,953,986	(A) 3,830	0	0	7	(Y) 352	0	2	126
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
91,030,401	1,109,855,702	580,012	36,595	85,130	618	38,067	17	30	127
5,511,453	508,518,530	391,344	50,366	19,670	312	15,729	3	11	128
(n)	(n) 215,213,935	117,419	22,159	939	463	(G) 24,061	9	14	129
2,058,347	132,809,343	48,372	8,428	313	681	(G) 4,858	3	(Z) 11	130
.....	.....	.....	.....	.....	.....	.....	.....	.....	131
2,154,800	104,725,947	94,074	11,937	382	250	.....	6	8	132
3,532,603	79,995,516	19,263	4,349	1,190	84	0	0	6	133
5,321,182	55,052,521	(h, i)158,273	(i)	(h,aa)10,362	(h) 254	.....	0	(h) 1	134
3,752,449	73,788,459	82,259	(bb) 9,343	(cc) 3,036	1	12	1	1	135
34,020,560	19,789,450	0	0	0	0	0	0	2	136
880,585	43,095,393	33,638	5,409	43	153	.....	.....	3	137
2,770,941	77,804,117	(ee) 18,055	(ff) 5,953	3,038	125	(gg) 3,310	0	14	138
9,536,342	37,690,331	27,456	5,222	.....	2	.....	1	15	139
3,520,136	44,383,494	(k) 41,381	7,889	.....	120	.....	2	5	140
9,408,405	26,741,331	57,400	11,397	4,833	23	.....	1	4	141
2,259,038	29,101,754	38,751	9,040	2,835	77	.....	.....	6	142
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	143
15,196,760	230,891,918	41,442	8,532	35	228	.....	.....	3	144
.....	11,000,000	(m) 20,132	(m)	23	85	0	1	3	145
.....	135,449,616	205,029	48,288	420	20	.....	1	14	146
.....	.....	.....	.....	4	.....	.....	.....	3	147
.....	75,195,560	.....	.....	.....	.....	.....	.....	.....	148
6,186,399	51,916,294	2,867	425	6	.....	.....	.....	7	149
.....	.....	.....	.....	.....	.....	.....	.....	.....	150
6,907,444	36,125,865	79,487	12,756	2,728	16	.....	.....	2	151
.....	49,221,630	9,126	2,232	46	13	.....	1	.....	152
.....	58,584,246	40,317	6,070	(nn)	7	.....	.....	2	153
.....	20,723,174	7,179	4,602	12	95	22	.....	.....	154
726,548	6,432,186	614	2	3	1	.....	.....	11	155
.....	7,203,218	20,478	4,879	68	114	(G) 1,300	1	5	156
0	0	0	0	0	0	0	0	2	157
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10,843,620	212,450,372	115,323	41,217	357	1,250	20,198	1	.....	158

(J) Fuel consumers and rural service.

(K) Company sells at wholesale only. No segregated classification.

(L) Leased plants.
The reported number and rating includes plants (not in general segregated as to kind of power) operated under contract or lease as follows:

Co. No.	No. of Plants	Kw.
2	1	50 (Hydro)
15	5	49,500
16	1	28,000 (Fuel)
17	1	40,800
39	2	..... (Hydro)
41	1	16,000 (Fuel)*
54	2	12,500
57	2	20,500
82	5	119,400
90	1	7,500
98	1	3,000
109	1	9,200 (Fuel)
111	1	2,000 (Fuel)
113	2	390
123	5	28,300
125	1	600
127	6	107,200
128	1	1,800
133	1	15,000 (Fuel)
140	1	1,100
153*	2	96,234(Hydro)*
154	1	12,975
169	2	16,000 (Hydro)

*River rights leased but plants owned by city.

(M) Net from interchange.

(N) Includes energy used in gas, water, bus or ice departments, or in combinations of such departments.

(O) Includes Kentucky & West Virginia Power Co. and Kingsport Utilities, Inc.

(P) Sales to municipal systems included under municipal service.

(Q) Includes Broad River Power Co. and Lexington Water Power Co.

(R) Includes rural service.

(S) Includes Carpenter development — first 28,000 kw. placed in service December, 1931.

(T) Includes 11,366 kw.-hr. free service.

(U) Operating.

(V) Of these thirteen are standby plants.

(W) Includes 226,251,694 kw.-hr., four customers, interchange.

(X) Includes, three plants, 2,100 kw. internal combustion.

(Y) Irrigation power.

(Z) Includes 106,000 kw.-hr., one customer, interchange.

(aa) Reported as commercial power (retail).

(bb) Commercial lighting.

(cc) Commercial power.

(dd) Includes Nevada-California Power Co., Southern Sierras Power Co. and Yuma Utilities Co.

(ee) Includes heat: residential, 1,804,310 kw.-hr., 1,270 customers.

(ff) Includes heat: commercial, 5,961,969 kw.-hr., 1,101 customers (the customers of notes *ee* and *ff* have been added to the totals, but presumably duplicate lighting customers.
—EDITOR)

(gg) Combination light and heat.

(hh) Includes 25,150 kw., 189,038,749 kw.-hr. sold as hydraulic power.

(ii) Includes Manitoba Power Co., Ltd., and Northwestern Power Co., Ltd.

(jj) Lower mainland system only.

(kk) Kva.

(ll) Standby.

(mm) Off-peak, central heating.

(nn) 1,378 customers included in other groups.

(oo) Horsepower.

(pp) Output of leased hydro plants.

(qq) These companies are listed, though their output in 1931 fell below 100,000,000 kw.-hr., because they have been included in the past and the decrease is assumed to be temporary.

rator Rating and Output

Plants and Generator Ratings— uel Plants— Rating Kw.	—Hydro Plants— No.	Rating, Kw.	Energy Generated (Net), Kw.-Hr.	Energy Purchased, Kw.-Hr.	Total Energy Output, Kw.-Hr.
21,401,794	**911**	**8,510,481**	**79,491,114,703**	**15,338,234,889**	**94,829,349,592**
1,554,990	122	682,118	5,105,053,243	1,402,233,884	6,507,287,127
6,436,482	199	1,655,120	22,872,471,728	2,816,971,510	25,689,443,238
6,515,310	134	310,048	17,694,670,223	5,162,899,640	22,857,569,863
1,662,485	67	538,120	5,522,292,617	109,901,168	5,632,193,785
1,778,112	115	1,367,414	6,773,729,970	1,736,052,887	8,509,782,857
550,530	26	820,553	3,161,735,385	1,326,593,418	4,488,328,803
1,358,333	14	45,541	4,080,650,533	805,755,464	4,886,405,997
132,840	74	651,322	2,337,727,935	311,451,482	2,649,179,417
1,412,712	160	2,440,245	11,942,783,069	1,666,375,436	13,609,158,505
96,289	**116**	**3,572,955**	**14,316,932,156**	**2,618,678,140**	**16,935,610,296**
32,240	**14**	**179,498**	**691,150,190**	**0**	**691,150,190**
1,170,227	**2**	**16,000**	**2,896,893,645**	**1,665,978,921**	**4,562,872,566**